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ABSTRACT

Presented are several hundred energy and environment-related instructional ideas and activities for grades K through 12. These brief suggestions are intended to serve as a resource bank of teaching ideas, rather than as a set of detailed lesson plans. Identified as to grade level, the activities are grouped into 8 sections which are each based on an energy conservation concept and series of general objectives. Educators may use this compendium as an activities guide, as a resource document for planning entire units, and as a tool for stimulating discussion in inservice programs. (Author/WB)

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# CONSERVATION of energy

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Idea and Activity Guide

An Interdisciplinary Teacher's Guide to

Energy and Environmental Activities

Section Eight

# CONSERVATION OF ENERGY

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RECYCLED PAPER

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## INTRODUCTION

The Energy & Man's Environment *Conservation of Energy Activity Guide* is designed for everyone involved in making educational sense out of the complex energy situation. It is especially appropriate for classroom teachers, curriculum writers, and other persons engaged in the preparation of learning experiences that relate to energy and the environment.

Educators have the organizational and intellectual resources to prepare our young people to deal knowledgeably and effectively with the delicate energy and energy-related environmental questions they will be asked to resolve. This new *Activity Guide* is designed to make this vital task an easier and more productive one.

This *Activity Guide* is a resource document with a wide variety of uses. A brief examination will reveal that it contains a conceptual framework and an organized listing of several hundred energy and environmentally related instructional *ideas* and *activities* for grades K-12. Each can be developed into a productive learning experience by a skillful teacher or curriculum developer. Use of the *Activity Guide*, therefore, depends largely upon the resourcefulness of the individual teacher and his or her knowledge and understanding of student needs.

The *Conservation of Energy Activity Guide* contains eight activity sections. Each section is based on an energy conservation concept and a set of general objectives.

The concepts, in the opinion of the EME staff, are necessary to a fundamental understanding of energy conservation. Listed under each general objective are several simply stated ideas or activities. These are multidisciplinary in nature and vary in their complexity. Each list of ideas or activities is intended to suggest possible alternatives for achieving an understanding of the concept under which they are organized. Each must, of course, be developed into a viable learning experience by the teacher or curriculum maker.

There are several specific ways in which educators have productively used the *Activity Guide*. It has been used as an idea bank from which individual teachers have extracted single innovative ideas for the occasional introduction of energy concepts into existing lesson or units of study. It has served as a resource document for planning instructional programs and/or units of study. And it has been a useful tool for stimulating discussions in professional inservice programs.

As an organization, EME has no single point of view to express, and advocates no particular position concerning questions or issues of technology or environment. In keeping with the traditions of academic integrity, EME seeks to encourage and support, in both its teacher training and curriculum development programs, an open forum for the presentation and discussion of ideas of every kind. However, we emphatically admit to encouraging balance and objectivity and to seeking energy and environmental literacy. We hope that these goals are clearly reflected in the *Activity Guide* and that our effort will assist in some small way to increase the probability for the wise and efficient use of all resources.

EME has designed several interrelated energy and energy-related environmental education resources. These teaching and resource documents include:

1. *Activity Guides* (for Sources, Uses, Conversion, Impacts, Limits, and Future Sources of Energy)
2. *Energy and Conservation Education: Activities for the Classroom* (complete lesson plan notebooks for grades K-3, 4-6, 7-9, and 10-12)
3. *Energy and Conservation Education Glossary*
4. *Energy and Conservation Education Bibliography*
5. *Energy Films Index*
6. Energy Calendars (classroom posters with activities)
7. Energy Eye Chart Posters
8. Energy Conservation Corps (a fifth and sixth grade community involvement activity)
9. The *Energist* (a newsletter for teachers, administrators, and curriculum planners)

Each resource is designed to serve a specific educational purpose. Combined, they provide an interrelated and mutually supportive collection of valuable tools which will enable the teacher or curriculum planner to easily integrate energy concepts into an existing program of studies.

Those who prepared this *Activity Guide* hope you will find it useful in your own effort to help young people become energy literate. Please let us know how *you* use the *Guide* and share with us the ideas you and your colleagues would like to have us add to the fund of ideas. A notation page has been included for this purpose. (See TABLE OF CONTENTS.) Thank you.

con'ser-va'tion (noun) 1. Energy conservation is the process of extending the useful life of the Earth's energy resources. 2. Protection of the assets and interests of others, such as children.

The energy dilemma is now a decade old! It has outlasted all wars in which our nation has been involved—and it will be an increasingly important part of our future. It is not now a ravaging crisis; but it has done something that no previous problem has been able to do: stop the American march toward a better life for all.

Confidence in the future has always been a national characteristic. In previous confrontations, Americans have exhibited a sense of unity and purpose. Today, there is a different national attitude. Few of us talk about what comes next. We seem to have lost both our drive to overcome the energy dilemma, and a clear vision of what exactly victory would be. Our energy goals are largely short term, self-serving, and ill-defined. We must begin to reestablish a positive purpose and action. One way to begin is by examining the context from which our present energy problems arise.

As the distinguished geological scientist, Dr. M. King Hubbert, stated not long ago, "It is difficult for people now alive, who have been accustomed to seeing steady exponential growth in the consumption of fossil fuel energy, to realize how short the fossil fuel epoch will seem when viewed over a significant span of human history." Dr. Hubbert estimates that in a period of only 13 centuries, mankind will have consumed the world's entire supply of fossil fuel; and, significantly, 80 percent of that will have been used up in the incredibly short period of only 3 centuries. Put another way, if we say that man's million year (more or less) tenure on earth is represented by a 12-inch ruler, this 3-century epoch of fossil fuel depletion covers only 1/20,000 of an inch!

Within this broader context, it is useful to know that in the flow of human civilization, many energy epochs have come and gone. For practical purposes, the record began when our ancestors moved away from an itinerant hunting and gathering existence into a more stationary, community life based on agriculture and the domestication of animals. This change resulted in far more efficient means of obtaining food energy. The next transition was from the burning of wood to the use of solar energy stored in fossil fuels. By making this transition, mankind passed out of an epoch based on renewable energy resources, to an epoch dependent on non-renewable resources. As a result, man's life was drastically altered. He began to deplete the finite resources of the earth.

Several key concepts are especially useful in establishing a perspective on our energy situation. First, the quantity of coal, oil, and natural gas stored through eons of time is staggering. It once seemed unlikely that these resources could ever be exhausted. However, while it is true that these precious fuels are being formed today by the same improbable geologic accidents by which they have always been created, the human appetite is consuming them at a rate billions of times faster than nature can replenish them. No thoughtful person today believes that fossil fuels exist as an infinite resource. For all practical purposes, the resources upon which our civilization is based are in imminent danger of being depleted before we can identify or perfect adequate replacements.

A second essential concept is the relationship between energy use and the world population that existing resources must sustain. The three-century period is notable not only for the incredible growth in fossil fuel use, but for the explosive increase in human population. It is axiomatic that a world whose population is doubling every 30 years is bound to experience food and other energy shortages. A viable corollary follows if we are reminded that *per capita* resource use must also be considered when contemplating the future of the human race.

A third concept worth careful consideration is the world distribution of energy resources. We Americans tend to think that our standard of living is a reward for our inherent skill and ingenuity. We neglect the fact that other nations have gone through similar stages of growth for reasons of similar geologic accident. The fact is, some places on earth have metal ores in close proximity to coal and water transportation. These have been the magic ingredients in the early stages of rapid industrialization of many countries. We became the energy and materials-intensive people we are because we had the resources to do so.

A fourth concept which is often ignored is the "law of diminishing returns." Simply stated, we use the easiest and closest (and therefore cheapest) resources first. As non-renewable energy sources become depleted, it is progressively harder to find more. New resources are inevitably found in increasingly remote areas, must be transported greater distances, and are available at increased cost. Under these circumstances, an increasing share of the resource is used in transportation, so—in net energy terms—less is available to the end user. Economists state this in terms of the "resource pyramid." The world has a few deposits of easily used high-grade resources and a very large supply of low-grade expensive ores. What a resource costs in energy subsidy (money) cannot in the long term be determined by political haggling or dictatorial fiat. Only supply and demand will make the determination. It *is* possible to greatly increase the supply of any resource if the users are willing to divert ever-increasing amounts of energy (human effort, energy, or capital) into extracting it. An energy resource is said to be depleted when it takes more energy (money) to get it than is contained in the resource itself.

A fifth concept is often stated in the following way: "You can't do only one thing; every act has multiple consequences, both positive and

negative." One of the negative consequences of our being are the inevitable waste products associated with every energy conversion process. (No process is 100% efficient.) The total amount of waste that is produced increases with lower resource grade, growing population, and greater per capita consumption. It is clear that the earth's biologic, geologic, and atmospheric systems have a finite capacity to absorb the wastes. For example, the world's weather appears to have already been altered by the use of fossil fuels which produce "harmless" carbon-dioxide in their burning. Simply put, the environmental cost of energy use must be considered along with economic and social implications. However, because long term environmental effects are difficult to reliably measure and interpret, we sometimes subordinate their consideration to more immediate concerns.

Finally, it is important to consider that America produces approximately 30 percent of the Gross World Product as a direct result of its energy use. However, this remarkable achievement is a two-edged sword. Cheap, readily-available energy necessary to sustain this productivity is no longer available at home. To meet our domestic requirements, we are forced to import ever-increasing amounts of oil and natural gas. A decade ago we were a net exporter of oil. In 1977, we imported nearly one-half of our petroleum requirements. Even drastic encouragement of domestic exploration and production is unlikely to change the picture, because U.S. consumers use more energy per capita than ever before. Huge oil imports have weakened the dollar in the world market as our balance of payments deficit increases. In short, our past and present energy habits have diminished U.S. influence abroad and have begun to erode our standard of living at home.

It is extremely difficult to accept personal responsibility for a problem as broad and complex as our energy dilemma. Perhaps as a consequence, a popular and convenient myth exists that someone else is responsible—industry, the petroleum companies, automobile manufacturers, foreign countries. But this approach is self-deluding and destructive. The facts are obvious and available in any library. The following data illustrate the point:

**Total U.S. Energy Use (1975)**

| Sector | Percent |
|---|---|
| Residential and Commercial | 38% |
| Industrial | 37% |
| Transportation | 25% |

There is no convenient scapegoat! Over 60 percent of the energy used in the U.S. is consumed by individuals in homes, stores, and private transportation! However, this is *good* news! It means that it *is* possible to successfully attack the problem at the human level, by influencing individual habits. In addition, since the 1973 oil embargo, most industrial and institutional energy users (your school included) have greatly *decreased* their energy use; in large part because it saves money. Conservation efforts in these sectors are working well indeed. Where is conservation *not* occurring?

A 1977 CBS News poll found that only one-third of those surveyed believed that the energy situation was "serious" and over one-half *didn't know that we imported any oil!* This existed in view of a nationally televised speech in which the President emphasized the seriousness of the energy situation by declaring it, "the moral equivalent of war." According to 1977 data from the Edison Electric Institute, residential consumers used 10 percent more electricity in 1977 than in the previous year. Consumer gasoline sales, sales of large private automobiles, and the rate of consumption of non-durable goods are also at record levels. Clearly the man in the street either doesn't know about the energy situation, doesn't want to hear about it, or doesn't care. It could be asked, "Is it fair and proper to close energy-efficient factories and schools so that we can keep our homes over-cooled or over-heated, drive our 'gas-hogs', and run our trashmashers to compress the huge volume of resources we casually discard?"

Clearly, encouraging the development of new energy sources is a high national priority. Undoubtedly, we will continue to produce and use the reserves we now have, but we *must* use our resources wisely. We must be wise and efficient, not just because conservation is the cheapest "source" of energy for the future, but because it is the best and perhaps only way we can personally contribute to the quality of life and standard of living of future generations. By accepting this as a personal responsibility, we become facilitators in the transition to a new energy epoch.

As educators, we have a unique challenge. We can help our students, their parents, and our colleagues know that the energy dilemma is a time of *opportunity*. We can act to help develop attitudes, skills, and the understanding that will serve our fellow man and improve the prospects of future generations. Educators are at the cutting edge of the effort to create energy literacy, and it is a thrust that must not fail.

The Energy & Man's Environment program assists educators by providing material support so that appropriate experiences can take place. With these materials, all disciplines within our profession can develop a working knowledge of energy fundamentals—where we get energy, how it is used, the means by which it is converted from one form to another, the environmental impacts of energy use, energy limits, and future sources and options. This document, part of a well-known series, focuses on conservation. We hope that it will provoke inquiry into this vital subject, that it will promote awareness and responsibility, and that it will introduce fresh teaching strategies for existing curricula in all disciplines and grade levels.

A. Dan Horn

**CONCEPTUAL FRAMEWORK**

## ENERGY CONSERVATION EDUCATION
### A Conceptual Framework

EME's DEFINITION OF ENERGY CONSERVATION: Energy conservation is the practice of extending the useful life of the earth's energy resources through wise or efficient management.

EME's PROGRAM GOAL: The students will understand and value practices which extend the useful life of the earth's energy resources.

EME's CONCEPTS:
1. Attempts to conserve energy are subject to natural laws.
2. Attitudes, beliefs and values influence the practice of energy conservation.
3. Attempts to conserve energy interact with economic conditions.
4. There are various methods to conserve energy.
5. Social and political institutions influence the practice of energy conservation.
6. Energy-related decisions affect lifestyles, quality of life and standards of living.
7. The earth's energy resources and systems can support only limited numbers of people.
8. Technological development affects energy conservation options.

**CONCEPT 1** Attempts to conserve energy are subject to natural laws.

General Objectives: The student:

1.1 will know that energy can neither be created nor destroyed (the First Law of Thermodynamics), but can be converted from one form to another.
1.2 will understand that the conversion of energy from one form to another results in a loss of available energy to the consumer (Second Law of Thermodynamics).
1.3 will know that natural systems tend toward an increase in entropy.
1.4 will know and understand that every organism uses and converts energy
1.5 will understand that man-made systems are subject to the laws of nature.
1.6 will understand that renewable and non-renewable energy resources exist.
1.7 will understand that the world's energy sources are limited.
1.8 will understand the interdependence of all natural systems and appreciate how interdependence affects the manner and extent to which resources may be used.
1.9 will be able to illustrate that humans can emulate systems which operate in nature to reduce energy use.

**CONCEPT 2** Attitudes, beliefs and values influence the practice of energy conservation.

General Objectives: The student:

2.1 will know that actions taken by earlier societies have influenced the availability of energy resources today.
2.2 will know that individuals and groups hold attitudes and values toward energy conservation which sometimes conflict.
2.3 will know the difference between the concepts of resource preservation and conservation.
2.4 will be able to determine that economic factors influence value decisions concerning energy conservation.
2.5 will know that energy conservation choices are influenced by existing value structures.
2.6 will understand that the earth's resources may be extended by practice of a social and personal conservation ethic.
2.7 will understand that conservation means different things to different people.
2.8 will understand that individuals have a personal responsibility for, and a relationship with, the use of the earth's energy resources.
2.9 will know that the failure to conserve resources has personal consequences and may result in a loss of personal options.
2.10 will understand that individuals can influence the conservation practices of others.
2.11 will understand that perceptions of needs and wants can vary with individuals.
2.12 will understand that each person can practice energy conservation.

**CONCEPT 3** Attempts to conserve energy interact with economic conditions.

General Objectives: The student:

3.1 will understand that changes in energy use both create and destroy jobs.
3.2 will understand that economic conditions influence energy conservation.
3.3 will understand that maintenance or improvement of environmental quality often requires large capital investment and increased energy use.
3.4 will identify which personal energy conservation practices require the investment of time and money.
3.5 will understand that energy conservation practices may improve the economic position of certain industries, businesses and institutions, and adversely affect others.
3.6 will understand that energy conservation practices can result in savings or additional cost.
3.7 will understand that the price of a resource is related to its availability and importance to society.
3.8 will understand that conservation of a resource becomes increasingly important as availability decreases.
3.9 will understand that the economic cost of developing alternative energy sources increases as the availability of existing resources decreases.
3.10 will understand that regulatory processes can have a positive or negative economic impact on conservation practices.

**CONCEPT 4** There are various methods to conserve energy.

General Objectives: The student:

4.1 will be able to understand the energy use and cost differences of throw-away, recycled, and reusable materials.
4.2 will understand that conservation practices differ in various societies.
4.3 will understand that energy resources can be used in a wasteful or unwasteful manner.
4.4 will understand that the more efficient a conversion process, the less waste.
4.5 will understand that consumption of natural resources can alter options available to future generations.
4.6 will understand that the volume of personal, agricultural, and industrial waste can be reduced.
4.7 will understand that placing the "true energy cost" on manufactured items could reduce waste.
4.8 will understand that economic, political and regulatory actions can encourage or discourage the practice of energy conservation.
4.9 will understand that energy can be conserved in homes, schools, industries, and communities.

**CONCEPT 5** Social and political institutions influence the practice of energy conservation.

General Objectives: The student:

5.1 will understand that the conservation of the earth's resources depends upon human decisions.
5.2 will understand that actions and events influence, extend, or exhaust available energy resources.
5.3 will value human organizations which influence energy conservation.
5.4 will understand that modern human societies historically have not often practiced energy conservation.
5.5 will understand that social and political acts have interrelated environmental and economic consequences.
5.6 will understand that the use or non-use of any energy source requires environmental trade-offs.
5.7 will understand that energy decisions made by one political entity have the potential of affecting other groups.
5.8 will understand that different governments must exercise different conservation policies because resources are unevenly distributed around the world.
5.9 will know and understand that conservation is practiced by human societies when alternatives are more distasteful or threatening.
5.10 will know and understand that individuals emphasize their own needs and wants before they emphasize conservation practices.

**CONCEPT 6** Energy related decisions affect lifestyles, quality of life and standard of living.

General Objectives: The student:

6.1 will understand that some persons and societies measure quality of life and standards of living by per capita energy consumption.
6.2 will understand that the practice of energy conservation may modify lifestyles.
6.3 will understand that different lifestyles require different amounts of energy.
6.4 will understand that present energy conservation practices affect the quality of life and standard of living of future societies.
6.5 will understand that short-term energy gains may result in long-term energy losses.
6.6 will understand that world population growth and energy conservation decisions will change occupational patterns and options.

**CONCEPT 7** The earth's energy resources and systems can support only limited numbers of people without drastic alterations in present technological and social systems.

General Objectives: The student:

7.1 will understand that population growth increases the pressure on the earth's resources.
7.2 will understand that per capita consumption affects the useful life of the earth's resources.
7.3 will understand the differences between linear and exponential forms of growth.
7.4 will understand that conservation planning is increasingly important as individual consumption of energy has increased faster than population growth.
7.5 will understand that the world distribution of resources and population poses political, social and economic hazards.

**CONCEPT 8** Technological development affects energy conservation options.

General Objectives: The student:

8.1 will understand that some technologies and activities use more energy than others.
8.2 will understand that some technological processes used in conservation practices use energy.
8.3 will understand that high technology societies have differing levels of responsibility to conserve the earth's resources than do low technology societies.
8.4 will understand that the rate of energy use with technological development has increased exponentially over time.
8.5 will understand that technologies are judged by their combined aesthetic, ethical/legal, utilitarian, and scientific impacts.
8.6 will understand that technological development is affected by the availability of resources.
8.7 will understand that humankind is using the earth's resources at an ever-increasing rate and this rate far exceeds the rate of energy resource replacement by biogeochemical processes.
8.8 will understand that industrial societies have a greater per capita impact on the environment than do agrarian societies.
8.9 will understand that conservation practices can reduce the environmental impact of technological development.
8.10 will understand that energy conservation practices create technological and industrial change.

# CLASSROOM ACTIVITY IDEAS

The activity suggestions presented in the next eight sections are intended only as a "resource bank" of ideas. In many cases, the educator will wish to further develop an idea to tailor it to an individual teaching style and/or classroom situation. The instructional activities have been categorized by grade levels: K-3, 4-6, 7-9, and 10-12. We have deliberately intermingled these activities to help teachers meet individual needs of students. Some K-3 activities are appropriate for some 4th and 5th graders. Conversely, some activities geared for older students can be used for acceleration.

*SPECIAL NOTE:* Educators who are looking for detailed lesson plans in energy conservation education should obtain the EME lesson plan notebooks, *Energy Conservation Education: Activities for the Classroom* (Grades 1-3, 4-6, 7-9, 10-12). Refer to the credit page for mailing address.

**concept:** 1 - Attempts to conserve energy are subject to natural laws.

**conservation**

Concept 1

**objective:** 1.1 - The student will know that energy can neither be created nor destroyed (the First Law of Thermodynamics), but can be converted from one form to another.

## activities

1. Conduct an experiment to determine if the conversion of energy from one form to another results in a net loss of energy. Plants create the energy represented by growth.

   Procedures:
   1) Prepare two identical seed beds, using cottage cheese containers, so that they weigh the same.
   2) Plant three bean seeds which have been soaked in water for twenty-four hours prior to planting.
   3) Add identical quantities of water to the containers.
   4) Place one container in sunlight and the other in complete darkness for three weeks.
   5) Water when necessary, using identical quantities of water.
   6) At the end of three weeks, weigh each container and compare the results.
   7) Form a series of hypotheses to explain the findings.

   SUGGESTED GRADE LEVEL: 4-9

2. Demonstrate the conversion of energy from one form to another by placing one gram of water in a test tube with a thermometer. Record the temperature. Weigh a peanut. Ignite the peanut with a match until it begins to burn. Place the flaming peanut, mounted on a pin, underneath the test tube in its holder until the peanut stops burning. Record the temperature at the moment of extinguishment. Weigh the peanut. Compute the number of calories of expended energy.

   Note: A calorie equals the amount of energy necessary to raise the temperature of one gram of water one degree Celsius.

   SUGGESTED GRADE LEVEL: 7-12

3. Invite a local physics teacher to explain and illustrate the Law of Conservation of Energy.

   SUGGESTED GRADE LEVEL: 4-12

4. Using the approved textbooks in physics for your school, compare their treatments of the First Law of Thermodynamics.

   SUGGESTED GRADE LEVEL: 7-12

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# activities

Concept 1
Objective 1.1 (continued)

5. Conduct or show a film depicting an Inca sun ceremony as a culminating experience for an appropriate social studies unit. Focus the class learnings on the universal adoration of the sun as the source of life in many of the world's religions. Using questioning strategies, elicit reasons from the class for this world-wide cultural focus. (Elicit agreement that the sun is the sole source of energy in the solar system--i.e., ours is a solar system.

SUGGESTED GRADE LEVEL: 4-12

6. Using a small alcohol burner, observe a small amount of alcohol burn until it is gone. What happened to the alcohol? Where did it go? (The teacher should explain to the class that burning alcohol changes into a gas and evaporates into the air.)

SUGGESTED GRADE LEVEL: K-3



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**concept:** 1 - Attempts to conserve energy are subject to natural laws.

**conservation**



**objective:** 1.2 - The student will understand that the conversion of energy from one form to another results in a loss of available energy to the consumer (Second Law of Thermodynamics).

## activities

1. Interview your local power representative, railroad freight agent, or economic geographer, and determine whether coal-fired steam plants should be located at the mine or at the point of use of the power produced.

   SUGGESTED GRADE LEVEL: 7-12

2. Interview 4-H club members who have cattle or hog projects to determine
   1) the amount of food consumed by the animal and the resulting net gain in weight.
   2) the differences found.
   3) how many pounds of food it took to produce one pound of weight gain.

   Compare these findings with similar investigations involving fish production or poultry production. What natural laws produced these phenomena? What changes in U.S. dietary habits might produce the greatest conservation of energy?

   SUGGESTED GRADE LEVEL: 5-12

3. Tour a hydroelectric facility with a representative from the organization operating the facility. Focus the interview on the loss of energy through the generation and transmission process.

   SUGGESTED GRADE LEVEL: 1-6

4. Using the approved textbooks in physics for your school, compare the different treatments of the Second Law of Thermodynamics.

   SUGGESTED GRADE LEVEL: 10-12

5. Explain why thermal power plants release waste heat to the environment. The Laws of Thermodynamics would need discussion before answering this question.

   SUGGESTED GRADE LEVEL: 10-12

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# activities

Concept 1
Objective 1.2 (continued)

6. Construct a food web to illustrate the transfer of energy from one level of consumer to another by collecting pictures of the following:
   - the sun
   - clouds
   - volcanoes
   - running water
   - rain forests
   - coal deposits
   - oil wells
   - salt mines
   - animals
   - parasites
   - saprophytes
   - scavengers

   Make an interaction diagram illustrating the conversion of energy from one form to another.

   SUGGESTED GRADE LEVEL: 4-6

7. Observe the teacher demonstrating a hot plate to the class. Relate this to electric ranges people use in homes. (The teacher should boil a cup of water so that students can see the heat working to make the water hot.) Taking turns, place a hand HIGH above the hot plate to feel the heat given off. Where is the heat going? (The teacher should explain that this is waste heat that is not being used.) This experiment should be done ONLY under close adult supervision.

   SUGGESTED GRADE LEVEL: K-3



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**concept:** 1 - Attempts to conserve energy are subject to natural laws.

**conservation**

**objective:** 1.3 - The student will know that natural systems tend toward an increase in entropy.

## activities

1. List examples of entropy and create interpretive illustrations of the principles of entropy by development of collages, bulletin boards, mobiles, and photo essays.

   SUGGESTED GRADE LEVEL: 7-12

2. Find a grove of oak trees that is infested with mistletoe. Determine why some trees seem to be dying. Find a dead oak tree that was infested with mistletoe. Determine why the mistletoe is dead or dying.

   SUGGESTED GRADE LEVEL: 1-3

3. Conduct a demonstration in front of the class to illustrate the process of entropy by winding the alarm on a clock and allowing it to run down. For younger groups, use a top, a wind-up toy, or a music box.

   SUGGESTED GRADE LEVEL: K-9

4. Ask the students to research the definition of entropy and give written examples of entropy in action.

   SUGGESTED GRADE LEVEL: 8-12

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**concept:** 1 - Attempts to conserve energy are subject to natural laws.

**conservation**

**objective:** 1.4 - The student will know and understand that every organism uses and converts energy.

## activities

1. As a group activity, research and create a mural depicting the sequential steps in the creation of coal.

   SUGGESTED GRADE LEVEL: 3-6

2. Form a circle and participate in the "Web of Life Game," wherein the teacher develops the concept of the food chain and the food web. Discuss the transfer of energy in a food chain. How is energy lost in a food chain or web? What would happen if an integral part of the system were removed? (Entropy.)

   SUGGESTED GRADE LEVEL: 4-9

3. Construct a bulletin board with a column of pictures of different plants and animals on one side and a column of pictures of their food and other energy sources on the other side. Using a stop watch, and selected teams from the class, match organisms to appropriate energy sources.

   Note: Include pictures of bacteria, fungi, parasites, etc.

   SUGGESTED GRADE LEVEL: K-6

4. Using back issues of National Geographic magazines, select pictures of people around the world. Using the encyclopedia in your library, identify the food habits of these people. Construct a world map and connect pictures of people with a list of their most typical foods. Each member of the class will select a food that is typical of h/er ethnic background and prepare a dish that classmates can sample at an international foods fair.

   SUGGESTED GRADE LEVEL: 4-9

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Concept 1
Objective 1.4 (continued)

5. Over a period of a month, one student should bring in a young pet and explain how to feed it. Bring the pet in at one week intervals to be weighed and measured. Explain to the class how the weight gain observed is related to the conversion of food energy into body weight.

SUGGESTED GRADE LEVEL: K-6

6. Obtain an approved biology text and make a comparative diagram depicting the digestive system of a cow and a dog. Label the diagrams and indicate how each part functions. Compare the process by which each animal builds muscle, bone and other tissues by digesting and assimilating different energy sources.

SUGGESTED GRADE LEVEL: 7-12



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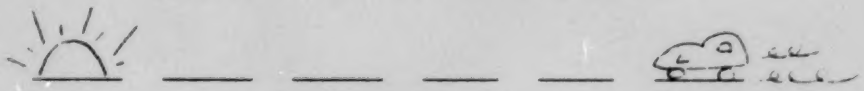
**concept:** 1 - Attempts to conserve energy are subject to natural laws.

**conservation**

**objective:** 1.5 - The student will understand that man-made systems are subject to the laws of nature.

# activities

1. On the chalkboard, draw the following diagram:



In an activity similar to "hangman," have the students suggest the correct object or words to be placed in the blanks. Develop the concept that the energy used to drive the car comes from the sun via other organisms, and that the energy in gasoline is not created by people.

SUGGESTED GRADE LEVEL: 4-6

2. Take a small model airplane motor; measure out one gram of gasoline for its fuel. Start the engine and time how long it takes the engine to consume the energy in the gasoline.

   Select a model with a larger engine. Supply it with fuel and run it for the same period of time. Then measure the gasoline consumed.

   How does the greater amount of energy consumed by the larger engine compare with the different amounts of food consumed by a mouse and an elephant? How does this discovery apply to the dinosaur, the Lincoln Continental and the American freeway system?

SUGGESTED GRADE LEVEL: 4-12

3. Visit an abandoned farm, orchard or car to observe and record the process of entropy as applied to man-made systems.

SUGGESTED GRADE LEVEL: 7-12

4. Duplicate examples of ancient writing systems from the book The Alphabet, or a similar book on the evolution of written languages. Distribute the samples to the members of your class and ask them to translate them with a story describing life in that society.

   Conduct a discussion concerning the concept that cultural systems are subject to entropic processes.

SUGGESTED GRADE LEVEL: 7-12

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Concept 1
Objective 1.5 (continued)

5. Before and after stormy weather, conduct a tour of the school site to show how the school building (a man-made system designed to house people) suffers from the natural phenomena of rain and/or snow. Structural problems with roofing, drainage, paint deterioration, and similar signs of wear will become obvious. Have the chief custodian or principal accompany the group if convenient. Similar investigations of landscaping, transportation, etc. can be conducted.

SUGGESTED GRADE LEVEL: K-3

6. Have students visit an area that has been abandoned--such as an orchard. Observe how the area is slowly reverting to its original condition. Note how insects are destroying the trees, how erosion is changing the surface of the land, and how weeds are covering the land that once was cultivated.

SUGGESTED GRADE LEVEL: K-3



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**concept:** 1 - Attempts to conserve energy are subject to natural laws.

**conservation**

**objective:** 1.6 - The student will understand that renewable and non-renewable energy resources exist.

## activities

1. Collectively define the difference between renewable and non-renewable resources and develop a list of energy sources that fall into these groups.

   SUGGESTED GRADE LEVEL: 4-9

2. Organize a forestry tour with a representative from a local timber company to observe logging techniques that illustrate the nature of
   - pre-commercial thinning
   - selective cutting
   - clear cutting
   - reforestation procedures

   SUGGESTED GRADE LEVEL: 4-12

3. Visit a mine, observe the mining process and discuss how the principal resource of that mine was formed. Discuss the concept of renewable and non-renewable resources.

   SUGGESTED GRADE LEVEL: 4-12

4. Visit a dam in the fall and again in the spring. Note the differences. Explain these differences as they impact on agriculture, hydroelectric power generation, and the price of aluminum.

   SUGGESTED GRADE LEVEL: 4-9

5. Illustrate the difference between a renewable and non-renewable energy resource by comparing the consumption of gas in a bunsen burner with the generation of power at a hydroelectric dam.

   SUGGESTED GRADE LEVEL: 7-12

6. Make a picture book illustrating renewable and non-renewable resources.

   SUGGESTED GRADE LEVEL: 4-6

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Concept 1
Objective 1.6 (continued)

7. Each student should plant grass seed in one container and a small piece of coal in another container. Observe the two containers for several days. Discuss why the grass grows and the coal does not. Which one is a renewable resource? Which one is a nonrenewable resource?

SUGGESTED GRADE LEVEL: K-1

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**concept:** 1 - Attempts to conserve energy are subject to natural laws.

**conservation**

**objective:** 1.7 - The student will understand that the world's energy sources are limited.

## activities

1. Ask a group of pupils to obtain and bring to class labeled samples or pictures of each of the following"
   - coal or charcoal
   - wood
   - oil
   - water

   Have these children present their samples and ask the rest of the class the following questions:
   - Where are these materials found?
   - Are we running short of any of these materials? Explain.
   - How are these materials used to give us energy?
   - What are some other energy sources?
   - Which materials are we running short of?
   - How may these materials be wisely used or saved?

   SUGGESTED GRADE LEVEL: 1-6

2. Given a graph showing the exponential rise in energy use since 1750, compute how long the coal reserves in the U.S. would last if they were our sole source of industrial energy.

   SUGGESTED GRADE LEVEL: 10-12

3. Conduct a class discussion and list the energy resources that are finite and relatively infinite. After the discussion, have each student select pictures of both types of resources from magazines. Collectively construct a bulletin board after determining the appropriateness of the suggested pictures.

   SUGGESTED GRADE LEVEL: 4-6

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Concept 1
Objective 1.7 (continued)

4. Reproduce the list below for your class and ask the students preparatory to making a report to select the items most relevant to the concept and discuss the unrelated items.

- The world's population is doubling every 35 years.
- The United States has increased its energy consumption by 4 or 5 percent for each of the past several years.
- Advertising encourages the sale of products which are not necessary or even desirable, but which will make money for the company.
- Oil painting on canvas is an art that is gaining in popularity as a hobby.
- The United States throws away 74 billion cans and bottles each year.
- Harnessing the tides and winds is being considered as an additional source of energy.
- The state of Connecticut is building a plant which will reclaim metals and other usable materials from garbage and trash, and turn most of the remaining trash into fuel.
- Unemployment has been on the rise in the United States, and is increasing again this year.
- Most of our beverages are packaged in nonreturnable bottles.
- Whales are on the endangered species list.
- Home air conditioners use approximately 2,000 kilowatt hours per year.
- National parks may find it necessary to require people to make applications for camping dates in order to prevent congestion and overuse.
- The United States has been manufacturing only two-thirds of the energy used and has been importing the rest.
- Cities do not want power plants built near them because of thermal pollution, visual pollution and danger of radiation.

NOTE: Adapted from Living Within Our Means: Energy & Scarcity, New York State Education Department.

SUGGESTED GRADE LEVEL: 7-12



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# activities

Concept 1
Objective 1.7 (continued)

5. Secure a list of the 15 strategic materials named by the U.S. Department of Defense. Determine how large the known reserves of these materials are in the world, the U.S., and your state.

SUGGESTED GRADE LEVEL: 10-12

6. Dramatize the concept that the world's energy resources are finite by producing a class play. The cast of characters are the different kinds of energy sources. Have the class list these sources. Next, decide in which order these sources will be depleted.

   Divide the class in as many groups as there are sources. One person in the group will represent the source in the play. The group will research its energy source and write lines for the play. Have the group construct a large picture, cut-out, or costume to represent the source. Each group should include an explanation, description, location, and projected depletion.

   The play should consist of each source telling its story and then dying on the stage to illustrate the fact that all energy sources are finite. The sun is the last to go out. Turn lights out.

SUGGESTED GRADE LEVEL: 1-6

7. Create a similar play to the one just described, in which the conflict occurs between the energy sources as beseiged cities facing the common and ultimately triumphant enemy--people.

SUGGESTED GRADE LEVEL: 7-12

8. Give each group of three children a small box of raisins. Explain that each group must try to make the raisins last one week. At the end of the fifth day, inventory to see how many raisins are left. At this point, discuss the fact that, like raisins, all Earth's resources are limited. It is just a matter of time before they are gone forever. Discuss the meaning of conservation and why it is important.

SUGGESTED GRADE LEVEL: K-3



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**concept:** 1 - Attempts to conserve energy are subject to natural laws.

**conservation**

**objective:** 1.8 - The student will understand the interdependence of all natural systems and appreciate how interdependence affects the manner and extent to which resources may be used.

## activities

1. Diagram a simple food chain and discuss the interdependence of the trophic levels. Discussion should include the flow of energy and nutrients through the system.

   SUGGESTED GRADE LEVEL: 4-12

2. Collect pictures from nature magazines and construct a collage illustrating a simple food web.

   SUGGESTED GRADE LEVEL: 1-6

3. Write an original play detailing what happens to the other members of a food chain when one member is removed. Make costumes or puppets for the principal characters and perform the play for some other class in your school, or in a nearby elementary school, or kindergarten.

   SUGGESTED GRADE LEVEL: 4-9

4. Obtain a camera and take pictures of the members of a food chain in your local environment. Make a bulletin board display of all your work.

   SUGGESTED GRADE LEVEL: 7-12

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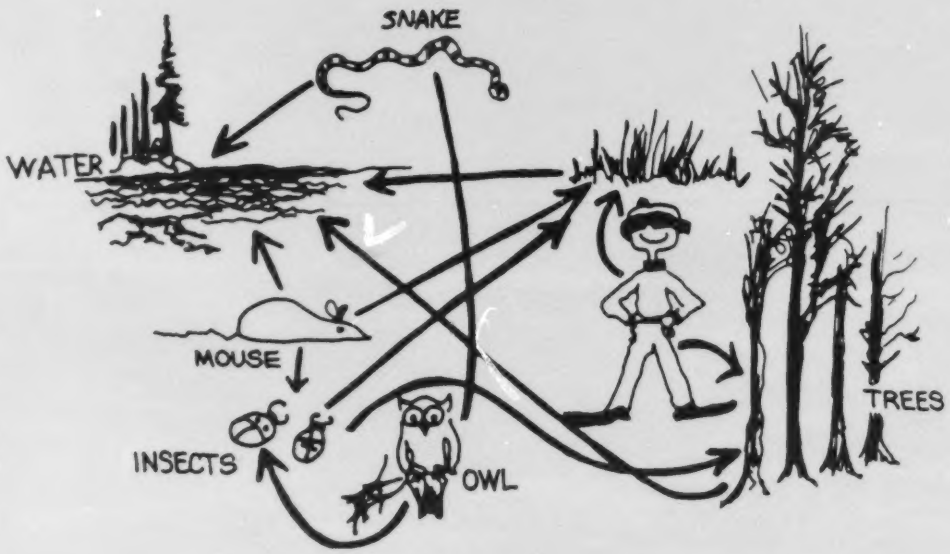
Concept 1
Objective 1.8 (continued)

5. Conduct a scavenger hunt and collect natural materials in a sack. Using colored marking tape or string, connect the different objects with string on the basis of their relationships to each other. Relationships might include: shelter, food, etc. Discuss each relationship with the students to illustrate the idea of a web of life. Then introduce humans! Do the relationships change? Finally, cut one of the strands and discuss what effect it has on the whole system.

SUGGESTED GRADE LEVEL: 4-12



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Concept 1
Objective 1.8 (continued)

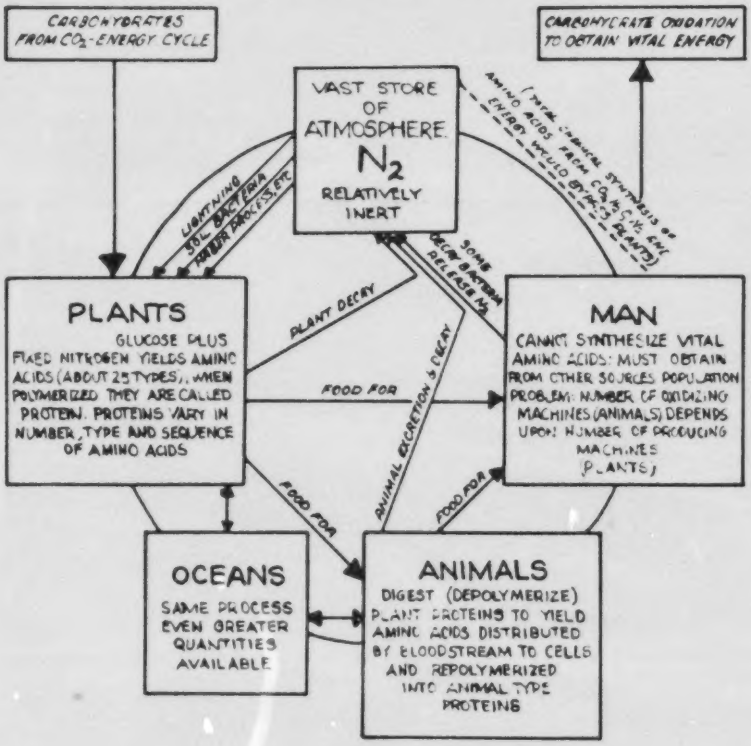
6. Discuss the concept of symbiosis with your class and give examples of each of the following interdependencies.
   - mutualism
   - commensalism
   - aggregation
   - predation

   Define the terms and select analogs that exist in the world's trade systems.

   SUGGESTED GRADE LEVEL: 10-12

7. Instruct members of the class to prepare illustrations of various Material Cycles which occur in an ecosystem. (Those which might be used are the Nitrogen, Oxygen, Carbon, Hydrogen, and Phosphorus Cycles.) Lead a general class discussion of materials cycles using the illustrations.

THE NITROGEN CYCLE


CARBOHYDRATES FROM $CO_2$-ENERGY CYCLE
CARBOHYDRATE OXIDATION TO OBTAIN VITAL ENERGY
VAST STORE OF ATMOSPHERE $N_2$ RELATIVELY INERT
LIGHTNING SOIL BACTERIA WATER ANALYSIS ETC.
SOME DECAY BACTERIA RELEASE $N_2$
PLANT DECAY
PLANTS
GLUCOSE PLUS FIXED NITROGEN YIELDS AMINO ACIDS (ABOUT 25 TYPES), WHEN POLYMERIZED THEY ARE CALLED PROTEIN. PROTEINS VARY IN NUMBER, TYPE AND SEQUENCE OF AMINO ACIDS
MAN
CANNOT SYNTHESIZE VITAL AMINO ACIDS: MUST OBTAIN FROM OTHER SOURCES POPULATION PROBLEM: NUMBER OF OXIDIZING MACHINES (ANIMALS) DEPENDS UPON NUMBER OF PRODUCING MACHINES (PLANTS)
FOOD FOR
ANIMAL EXCRETION & DECAY
FOOD FOR
FOOD FOR
OCEANS
SAME PROCESS EVEN GREATER QUANTITIES AVAILABLE
ANIMALS
DIGEST (DEPOLYMERIZE) PLANT PROTEINS TO YIELD AMINO ACIDS DISTRIBUTED BY BLOODSTREAM TO CELLS AND REPOLYMERIZED INTO ANIMAL TYPE PROTEINS

(Continued)



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# activities

Concept 1
Objective 1.8 (continued)

7. (continued)

Ask the following questions pertaining to the Nitrogen Cycle:
-Why do animals (and people) need nitrogen?
-How do they obtain this nitrogen?
-Free nitrogen constitutes 78 percent of the air. Can this nitrogen be used by plants and animals? Explain.
-How do plants obtain nitrogen?
-Name some scavengers, decomposers, and saprophytes and explain their role in the Nitrogen Cycle.
-Does man effectively recycle the materials he uses?
-In what ways may we achieve more efficient use of our resources through recycling?
-Select some form of recycling process conducted by humans, and explain what steps approximate those roles performed by scavengers and decomposers in the Nitrogen Cycle.
-Why is it necessary that society become aware of the extreme importance of recycling?

SUGGESTED GRADE LEVEL: 10-12



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**concept:** 1 - Attempts to conserve energy are subject to natural laws.

**conservation**

**objective:** 1.9 - The student will be able to illustrate that humans can emulate systems which operate in nature to reduce energy use.

## activities

1. Draw a site development plan to improve energy conservation provided by vegetation on your chosen site. Wrap the appropriate new plantings*; estimate the costs and the savings in energy. Submit the plan to the appropriate persons.

   *Use Sunset magazines's Western Garden Book to determine shade value, growth form and rate, hardiness, pollution resistance of various trees and shrubs.

   Enlist community support by involving the local garden groups, PTA, Parks Department, U.S. Forest Service, nurseries, soil and water conservation district representatives and agricultural experts from 4H, extension service, etc.

   Celebrate Arbor Day by a formal implementation of your plan with appropriate ceremonies.

   SUGGESTED GRADE LEVEL: 7-12

2. Compare the sun orientation of lizards (they orient themselves at right angles to the sun's rays to gain maximum exposure on cold days) with the location of windows on solar heated houses.

   SUGGESTED GRADE LEVEL: 7-12

3. Using a protractor or an inclinometer, measure the roof angles of your house; compare the findings with the optimum angle of capturing solar energy at your latitude; create a tentative plan to place a solar panel on your home.

   SUGGESTED GRADE LEVEL: 7-12

4. Why are planes designed much like flying birds? Have your students pretend they are flying around the room. Flap wings and glide; flap wings and glide. Discuss why birds glide. Relate this to conserving energy, as planes are designed to reduce as much energy use as possible, too.

   SUGGESTED GRADE LEVEL: K-3

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# activities

Concept 1
Objective 1.9 (continued)

5. Contact your local representative of the State Fish and Game Department and obtain examples of different animals found in your area. Place the hides and stuffed animals on a table and ask the students to arrange them in piles on the basis of how they keep warm. (Feathers, dead air space, dense fur, scales, etc.)

   Discuss how this knowledge of natural mechanisms is used by people to conserve energy.

   Discuss and illustrate how this knowledge can be used in the selection of winter clothes.

   SUGGESTED GRADE LEVEL: 1-6

6. Have students arrange a display of sleeping bags from a local sporting goods store. Have a representative from the store explain the importance of varying insulation patterns, type of construction, etc. Comparisons between old and new bags will show the relationship between heat loss and depth of insulation.

   SUGGESTED GRADE LEVEL: 4-6

7. Discuss analogical relationships that exist between home insulation practices world-wide and the physical response of various animals to cold. Consideration may be given to items like:
   - bird behavior in cold weather (dead air space)
   - winter coats on domestic animals, such as cows, horses, cats and dogs (dense fur)
   - whale blubber

   SUGGESTED GRADE LEVEL: 4-12

8. Have your students find books in the library that tell stories of animals hibernating and migrating to escape inclement weather. Discuss the stories and how we can emulate these systems.
   - Which animal would you rather copy?
   - Which system would conserve the greatest amount of energy?

   SUGGESTED GRADE LEVEL: 1-6



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CONCEPT 2

**concept:** 2 - Attitudes, beliefs and values influence the practice of energy conservation.

**conservation**

**objective:** 2.1 - The student will know that actions taken by earlier societies have influenced the availability of energy resources today.

# activities

1. Complete library research to list historical actions which might have influenced availability of resources today.

   SUGGESTED GRADE LEVEL: 4-6

2. Prepare a chart of energy resources which are in scarce supply today.

   SUGGESTED GRADE LEVEL: 1-3

3. Brainstorm which prior actions of people have increased availability of resources today.

   SUGGESTED GRADE LEVEL: 4-6

4. Pretend you are historians in the year 2080 documenting the decisions of our society today which influenced the energy available to them.

   SUGGESTED GRADE LEVEL: 4-6

5. Produce a dramatization of a town hall meeting held in the year 1700, 1800, 1900 at which citizens provide discussion of the consequences of energy resource conservation actions. Have both pro/con speakers so that the debate might be stimulated.

   SUGGESTED GRADE LEVEL: 7-9

6. Research the position that selected North American Indian tribes hold toward the natural environment. Invite a speaker from these groups to come to the classroom to discuss the Indian point of view.

   SUGGESTED GRADE LEVEL: 7-9

7. Interview parents to speculate about how their occupations or careers might change if energy resources become very scarce.

   SUGGESTED GRADE LEVEL: 4-9

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# activities

Concept 2
Objective 2.1 (continued)

8. Research and list ways in which your older relatives (i.e. uncles, aunts, grandparents, etc.) personally implemented energy saving practices in the past. Find out if they conserved because they had to or because they wanted to. Invite an older person (senior citizen) to class to talk with students about how energy was conserved in the past.

SUGGESTED GRADE LEVEL: K-6

9. Write a story or poem telling how the future will change if energy resources become very scarce. Possible titles could include "The Lost Forest," "No More Cars," "Look At What's Happened!," "Where Were You When The Lights Went Out," etc. Have older students read their stories to primary students.

SUGGESTED GRADE LEVEL: 3-6

10. Prepare a time capsule to be opened in 100 years which contains examples of how our present society has provided the future society with abundant energy resources.

SUGGESTED GRADE LEVEL: 4-12

11. Contact your State Department of Natural Resources and determine which steps they are taking to conserve the energy resources of the state.

SUGGESTED GRADE LEVEL: 4-9

12. Find out who owns and/or controls the forested areas of your county and state. These might be private individuals, corporations, the U.S. Forest Service, the state, or others. Have the different owners renewed this resource for the future or not?

SUGGESTED GRADE LEVEL: 5-12



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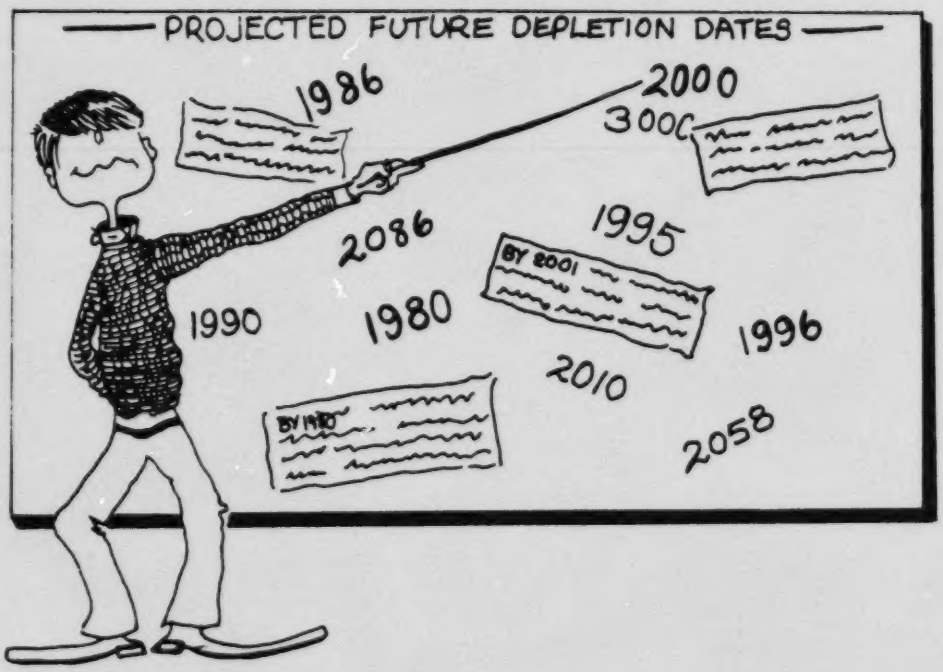
Concept 2
Objective 2.1 (continued)

13. Among the few renewable energy resources is wood fuel. However, abuse could quickly make it nonrenewable. To prevent a total loss of wood as both an energy source and a building or shelter, public policy has required that national forests be harvested so that the forests can be renewed. Man has not always followed this policy. Attempt to discover which ancient and modern civilizations lost their forest resources. Discuss how the renewal of forest resources either helps or hinders individuals and societies.

SUGGESTED GRADE LEVEL: 10-12

14. Chart five resources in the U.S. How many years will each last at the present rate of consumption? Is there a need to conserve any of these resources? Which ones?

SUGGESTED GRADE LEVEL: 10-12



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**concept:** 2 - Attitudes, beliefs and values influence the practice of energy conservation.

**conservation**

**objective:** 2.2 - The student will know that individuals and groups hold attitudes and values toward energy conservation which sometimes conflict.

## activities

1. Invite speakers with opposing views to debate energy conservation issues in front of the class.

   SUGGESTED GRADE LEVEL: 10-12

2. Interview persons who have definite energy/conservation points of view with a tape recorder. Summarize attitudes/values and list on a chart to post in the classroom. Make the tape available for listening.

   SUGGESTED GRADE LEVEL: 4-9

3. Cut articles out of the newspaper which illustrate opposing energy conservation views and post on the bulletin board.

   SUGGESTED GRADE LEVEL: 4-9

4. Write to energy companies and ask for a response to the question: "Which values/attitudes/beliefs does your company hold that conflict with energy conservation groups, and why do you believe these differences exist?"

   SUGGESTED GRADE LEVEL: 7-9

5. Prepare a list of value statements on cards and allow students to discuss in small groups the good reasons for having that point of view. Then switch and discuss the bad reasons.

   SUGGESTED GRADE LEVEL: K-6

6. Using your state budget for last year, compute the total number of employees of the various state energy agencies involved in energy conservation. Contrast the total with corresponding data for energy producers and users in your state.

   SUGGESTED GRADE LEVEL: 10-12

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**concept:** 2 - Attitudes, beliefs and values influence the practice of energy conservation.

**conservation**

**objective:** 2.3 - The student will know the difference between the concepts of resource preservation and conservation.

## activities

1. Look up the definitions of preservation and conservation in the dictionary and write in your own words the essential difference.

   SUGGESTED GRADE LEVEL: 4-12

2. On a chart, list resources which should be conserved, are being conserved, should be preserved, and are being preserved.

   SUGGESTED GRADE LEVEL: 1-12

3. Write an essay explaining why controlled and planned use is better than no use at all.

   SUGGESTED GRADE LEVEL: 4-12

4. Debate non-use of resources vs. planned use of resources.

   SUGGESTED GRADE LEVEL: 7-12

5. Map the wilderness areas of the geographic region in which you live.

   SUGGESTED GRADE LEVEL: 4-12

6. Prepare a list of laws which have the effect of preserving natural resources.

   SUGGESTED GRADE LEVEL: 4-12

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**concept:** 2 - Attitudes, beliefs and values influence the practice of energy conservation.

**conservation**

**objective:** 2.4 - The student will be able to determine that economic factors influence value decisions concerning energy conservation.

## activities

1. Ask local writers of environmental impact statements to discuss what goes into the statements, why they are done in the first place, and the role economics plays in causing the statements to be written.

   SUGGESTED GRADE LEVEL: 7-12

2. Write local companies to determine the cost of implementing energy conservation practices.

   SUGGESTED GRADE LEVEL: 4-12

3. Determine which countries exert the greatest influence on the world community at the present time. Compare this listing with the per capita wealth of the citizens of that country. Compare this data with their control of energy resources.

   SUGGESTED GRADE LEVEL: 7-12

4. Determine the approximate costs to install energy conservation equipment and practices in your own home--costs both in time and money.

   SUGGESTED GRADE LEVEL: 4-12

5. Simulate a business producing a product which has been hit with the need to add energy conservation technology to its plant. Determine the cost rise for the company's product as a result of this decision.

   SUGGESTED GRADE LEVEL: 7-12

6. Role play the president of a company, director of marketing, and director of energy savings. Have directors debate increased product cost to the public vs. wasteful energy conservation practices and have the president make the final decision.

   SUGGESTED GRADE LEVEL: 10-12

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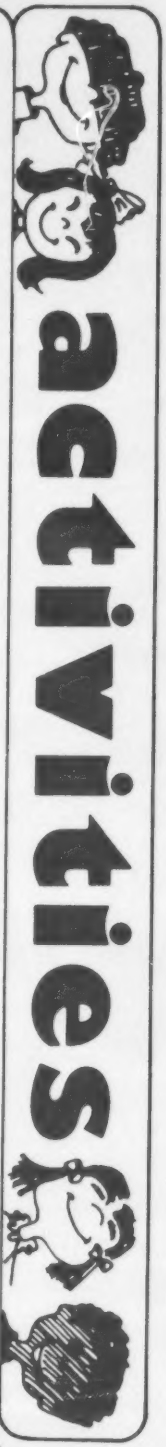
**concept:** 2 - Attitudes, beliefs and values influence the practice of energy conservation.

**conservation**

**objective:** 2.5 - The student will know that energy conservation choices are influenced by existing value structures.






1. List conservation practices which could be adopted in homes and explain why some individual familes have failed to adopt these practices.

   SUGGESTED GRADE LEVEL: 4-6

2. Invite people from various cultural backgrounds to share their beliefs and attitudes about energy conservation.

   SUGGESTED GRADE LEVEL: K-12

3. Identify individual and/or social actions which might be interpreted as reflective of energy conservation values.

   SUGGESTED GRADE LEVEL: 4-12

4. Invite a militant native American spokesperson to class to discuss the religious attitudes held by many American Indians toward the use of land and nature.

   SUGGESTED GRADE LEVEL: 7-12

5. Invite a member of a local conservation group such as the Sierra Club and a member of your local 4-wheeler organization to debate their differing attitudes toward using off-road vehicles in wilderness areas.

   SUGGESTED GRADE LEVEL: 7-12

6. Observe television for an evening and record the differing attitudes toward energy conservation exhibited by the advertisers.

   SUGGESTED GRADE LEVEL: 7-12

7. Pick one favorite possession which is made of man-made material (plastic or synthetic fiber). Also, select a short motor trip you would like to take.

   SUGGESTED GRADE LEVEL: K-6



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# activities

Concept 2
Objective 2.5 (continued)

8. NOTE TO TEACHER: Many, if not all, of the activities dealing with recycled materials can be used to teach this concept. Look at the activities under Concept 4, Objective 4.1 and 4.6; Concept 5, Objective 5.2.



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**concept:** 2 - Attitudes, beliefs and values influence the practice of energy conservation.

**conservation**

**objective:** 2.6 - The student will understand that the earth's resources may be extended by the practice of a social and personal conservation ethic.

## activities

1. Write a personal conservation ethic. A composite classroom conservation creed will be developed by the students working in small groups and then all together.

   SUGGESTED GRADE LEVEL: 4-6

2. Write organizations devoted to conservation and ask for a copy of their conservation ethic. Compare the copies with each other and determine the best features of each.

   SUGGESTED GRADE LEVEL: 4-12

3. List ways in which one individual can communicate attitudes concerning energy conservation to others.

   SUGGESTED GRADE LEVEL: 4-12

4. Make a picket sign which displays your own personal ethic which conflicts with the practices of others. A rally will be held before all students during the lunch period.

   SUGGESTED GRADE LEVEL: 7-12

5. Pretend you are going on a camping trip 200 miles from home. The length of the vacation is two weeks. You wish to spend as little money as possible, spend as much time in the wilderness as possible, and save as much energy as you can. Based on these requirements, select a mode of travel, cooking fuel, housing en route, housing at the camp site, types of activities during the period at camp.

   SUGGESTED GRADE LEVEL: 4-12

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Concept 2
Objective 2.6 (continued)

6. Obtain an Igloo water cooler--5 gallons. Weigh the container empty and then when it is full of water. Have an agreement among all class members that this cooler is the only place they will get their drinking water. Allow students to obtain a drink whenever they wish and record the length of time it takes to use all the water. (The amount of water in the container cannot be seen, so the class will not know how much of the "resource" remains.)

   Next, refill the container and again have students use this as their only source of water. This time, weigh the water taken each time a student gets a drink (use grams). Keep a running subtraction record and see how much longer the "resource" will last.

   SUGGESTED GRADE LEVEL: K-3

7. Display a bowl of raisins in front of the room. Tell the students that they are going to experiment with raisins by eating them. Also, tell the students that they must see if they can make the raisins last for several days. Explain to the students that the supply is limited. When the raisins are gone, they will not be replaced. Anyone who wants a raisin is free to eat one. An honor system will determine how long the raisins will last. Discuss with students the term limited and its implication to the earth's energy resources (i.e. resources are limited or finite).

   SUGGESTED GRADE LEVEL: K-3

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**concept:** 2 - Attitudes, beliefs and values influence the practice of energy conservation.

**conservation**

**objective:** 2.7 - The student will understand that conservation means different things to different people.

## activities

1. Receive an allocation of food products (some that will spoil and some that are not likely to spoil) and be told that you are to conserve it for a week with no other information. At the end of the period, students will tell how they used or failed to use their food and develop a definition of conservation.

   SUGGESTED GRADE LEVEL: 1-12

2. Provide the students with a very large jar of peanuts which all may share but must last for two weeks. Document the process of peanut consumption.

   SUGGESTED GRADE LEVEL: K-12

3. Each student will receive a liter of water to use for various pre-selected purposes--watering plants, drinking, fish-bowl, painting, window washing, cleaning desk top, cleaning sink, etc. Structure the situation so that students will be forced to make a decision regarding cooperative use of the water.

   SUGGESTED GRADE LEVEL: K-9

4. Each student will interview a number of people in the community regarding their definition of conservation. All responses will be recorded and a composite will be made of all the different answers.

   SUGGESTED GRADE LEVEL: 4-12

5. A student will write a definition of conservation on the blackboard. Other students, one at a time, will come to the board and modify the definition (change, add, delete) at their discretion.

   SUGGESTED GRADE LEVEL: 7-12

6. Write to your congressional and legislative representatives for the representatives' personal definition of conservation.

   SUGGESTED GRADE LEVEL: 4-12

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**concept:** 2 - Attitudes, beliefs and values influence the practice of energy conservation.

**conservation**

**objective:** 2.8 - The student will understand that individuals have a personal responsibility for, and relationship with, the use of the earth's energy resources.

## activities

1. Discuss how your lives will be affected by decisions regarding energy resources, even though you may or may not choose to take part in energy conservation practices.

   SUGGESTED GRADE LEVEL: 4-6

2. Document decisions made at home and at school regarding the conservation of energy resources in which you participated. You will document who was involved in any decisions and what those decisions were.

   SUGGESTED GRADE LEVEL: 4-6

3. Recommend to your home and school a listing of conservation practices which should be instituted.

   SUGGESTED GRADE LEVEL: 1-3

4. Write the editor of the local paper to detail ways in which the city might conserve energy. Any other public body might be chosen.

   SUGGESTED GRADE LEVEL: 7-12

5. Discuss the personal consequences to you of decisions in the energy area made by others in which you have had no voice.

   SUGGESTED GRADE LEVEL: 4-9

6. Write an essay on the topics: "Refusing to make a decision is a decision in itself," and "A small minority usually makes the decisions for the apathetic majority."

   SUGGESTED GRADE LEVEL: 4-9

7. Analyze the voting record of your congressman on energy-related legislation.

   SUGGESTED GRADE LEVEL: 7-9

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Concept 2
Objective 2.8 (continued)

8. write to industries and conservation organizations to obtain examples of instances where individuals' suggestions concerning energy conservation practices were adopted.

SUGGESTED GRADE LEVEL: 4-6

9. Determine how you may become involved in energy decisions in your home, school and community.

SUGGESTED GRADE LEVEL: K-3

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**concept:** 2 - Attitudes, beliefs and values influence the practice of energy conservation.

**conservation**

**objective:** 2.9 - The student will know that failure to conserve energy has personal consequences and may result in a loss of personal options.

## activities

1. Prepare and deliver a simulated radio broadcast/TV broadcast/ newspaper release which explains the consequences of the fact that a certain energy resource has suddenly been depleted.

   SUGGESTED GRADE LEVEL: 4-6

2. Simulate the loss of an energy resource in your lives by living for a week (day) as if the resource had been totally eliminated.

   SUGGESTED GRADE LEVEL: K-3

3. Invite a senior citizen to the classroom to discuss any changes s/he has observed in h/er life caused by the reduction of the earth's resources. List the first and last ten personal convenience items s/he would give up in priority order to conserve energy.

   SUGGESTED GRADE LEVEL: 4-6

4. Lift maximum weight and record total. Then run a mile as fast as possible and immediately lift the maximum weight again and record the difference. Draw conclusions about personal consequences of energy use.

   SUGGESTED GRADE LEVEL: 7-12

5. Develop "energy police," much like traffic police or narcotic police, and describe the role they might play as the competition for scarce energy resources becomes intense.

   SUGGESTED GRADE LEVEL: 7-9

6. Determine which wars or conquests have been undertaken as a result of a desire to acquire energy resources.

   SUGGESTED GRADE LEVEL: 7-12

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**concept:** 2 - Attitudes, beliefs and values influence the practice of energy conservation.

**conservation**

**objective:** 2.10 - The student will understand that individuals can influence the conservation practices of others.

# activities

1. Take a list of energy conservation ideas home to see which ones you can influence your parents to adopt.

   SUGGESTED GRADE LEVEL: 4-6

2. Document examples of how you have influenced conservation practices of others.

   SUGGESTED GRADE LEVEL: 4-6

3. Visit a regulatory body (legislative, utility board rate hearing, etc.) to observe the role individuals play in influencing decisions.

   SUGGESTED GRADE LEVEL: 7-9

4. Provide examples of how joining with others of similar ideas can make available more power than individuals possess alone.

   SUGGESTED GRADE LEVEL: 4-6

5. Within your family, find examples of wasteful energy practices. Attempt to influence family members responsible for the waste to change their practices by talking directly to them. (Tell the students that they have to have non-wasteful practices first before they point out wastefulness to others.)

   SUGGESTED GRADE LEVEL: K-6

6. Using your state budget for last year, compute the total number of employees of the various state energy agencies involved in energy conservation; contrast the total with corresponding data for energy producers and users in your state.

   SUGGESTED GRADE LEVEL: 10-12

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**concept:** 2 - Attitudes, beliefs and values influence the practice of energy conservation.

**conservation**

**objective:** 2.11 - The student will understand that perceptions of needs and wants can vary with individuals.

## activities

1. Make a list of what you believe are absolute survival needs and a list of items you now have or want to have that represent wants.

   SUGGESTED GRADE LEVEL: 4-6

2. Discuss alternate lifestyles as a direct function of needs and wants.

   SUGGESTED GRADE LEVEL: 4-6

3. Discuss the role that advertising plays in creating artificial needs and wants and the "change to something new" ethic.

   SUGGESTED GRADE LEVEL: 4-6

4. Create a collage of advertisements which are designed to cause the consumer to want something new which does not necessarily satisfy a basic need.

   SUGGESTED GRADE LEVEL: 1-3

5. Divide the class into three groups. One group will represent a society living in the Arctic, another will represent a society living in Central Africa, and a third will represent a middle class society in the United States.

   Have each group research the lifestyles of its society and prepare a basic list of those things needed to survive within the society. Each group should list these needs in a manner for sharing with the rest of the class.

   Discuss the similarities and differences among the three societies.

   SUGGESTED GRADE LEVEL: 7-9

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**concept:** 2 - Attitudes, beliefs and values influence the practice of energy conservation.

**conservation**

**objective:** 2.12 - The student will understand that each person can practice energy conservation.

# activities

1. Walk more; ride less. Record activities in a daily log. Compare your results with a classmate.

   SUGGESTED GRADE LEVEL: 4-6

2. List a variety of activities students can personally do to save energy.

   SUGGESTED GRADE LEVEL: K-12

3. Implement Item 2.

   SUGGESTED GRADE LEVEL: K-12

4. Invite a local energy supplier to school to discuss and distribute that firm's suggestions for energy conservation activities.

   SUGGESTED GRADE LEVEL: 4-12

5. Create a convincing cartoon series illustrating ways to save energy, using the following cartoon characters: Margaret Megawatt, Ollie Ohms, Victor Voltage, Dim Bulb, Flora Fluorescent, Burt Bulb, etc.

   SUGGESTED GRADE LEVEL: 4-12

6. List ways to conserve energy by changes in classroom behavior. Act on them. Record and evaluate changes as a class activity.

   SUGGESTED GRADE LEVEL: K-8

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CONCEPT 3

**concept:** 3 - Attempts to conserve energy interact with economic conditions.

**conservation**

**objective:** 3.1 - The student will understand that changes in energy use both create and destroy jobs.

# activities

1. Describe products specifically designed to conserve energy. Related to this, predict the market for these products and the employees needed to supply this market.

   SUGGESTED GRADE LEVEL: 4-12

2. Describe new industries that have greatly expanded because of energy conservation practices, e.g. bus companies because of shift to more mass transit, insulation industries, new insulating products, new low-energy lighting and heating products, etc.

   SUGGESTED GRADE LEVEL: 7-12

3. Explain how conserving energy creates the need for new inventions.

   SUGGESTED GRADE LEVEL: 7-12

4. Explain how each of the following energy conservation practices creates additional and/or different occupations.
   - mass transit
   - recycling containers, paper, etc.
   - small cars
   - increased freight transportation by train and decreased freight transportation by trucks
   - less use of chemical fertilizer in agriculture

   SUGGESTED GRADE LEVEL: 4-12

5. If it is true that some packaging is non-essential, and is thereby a wasteful use of natural resources (raw material and energy), what specific jobs would be affected by the elimination of excessive packaging?
   - List jobs affected.
   - Determine whether an increase or decrease in the cost of the item would result.
   - What problems of shipping and storage would result?
   - Itemize sanitary implications for ten grocery or drugstore items that are edible.
   - Explore other economic implications.

   SUGGESTED GRADE LEVEL: 7-12

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# activities

Concept 3
Objective 3.1 (continued)

6. Research and predict kinds of new jobs created or renewed as the result of severe limits placed upon energy use.

SUGGESTED GRADE LEVEL: 6-12

7. Assume you are the mayor of your city. Describe the qualifications of the person you would hire to establish a public transportation system. Include educational background, occupational experience, political philosophy and other factors considered important. How would s/he be expected to approach the problem? To whom would s/he be answerable?

SUGGESTED GRADE LEVEL: 6-12

8. Discuss the jobs that would be affected and the sources of energy that would be made more available if the principal mode of transportation in a city were to change from private automobile to mass transit (buses, trains).

SUGGESTED GRADE LEVEL: 6-12

9. It has been suggested that through greater use of public transportation (buses, trains) private citizens would use less fuel in their cars. Suppose this were put into action. List the fuels that would be saved. Who might lose jobs? What jobs would be created?

SUGGESTED GRADE LEVEL: 1-6



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**concept:** 3 - Attempts to conserve energy interact with economic conditions.

**conservation**

**objective:** 3.2 - The student will understand that economic conditions influence energy conservation practices.

## activities

1. Calculate the real cost of insulating a specific home, considering the economic return in energy cost savings compared to the return over the same period of other investments, such as bank deposits, stocks, bonds, etc.

   SUGGESTED GRADE LEVEL: 10-12

2. Trace the effect of an energy conservation investment by an industry on:
   - price of the industry's product
   - payroll
   - capital vs. capital formation
   - loans

   SUGGESTED GRADE LEVEL: 4-12

3. Have students list ways to conserve pencils, paper, crayons, etc., and at the same time compute the savings their attempts to conserve provide. If your school has a store, have the students determine if this conservation activity affected the sale of pencils, paper and crayons. Discuss the implications of conserving vs. the sale of products.

   SUGGESTED GRADE LEVEL: 4-6

4. Using the Statistical Abstract of the U.S. or consulting your local gasoline distributor, determine the effect of the 1973 oil embargo on the price of gasoline. Then, after consultation with their parents, have the students discuss their particular families' efforts to cope with rising gasoline prices.

   SUGGESTED GRADE LEVEL: 9-12

5. When gasoline costs $1.50 a gallon, what changes will occur in your personal conservation practices?

   SUGGESTED GRADE LEVEL: 7-12

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Concept 3
Objective 3.2 (continued)

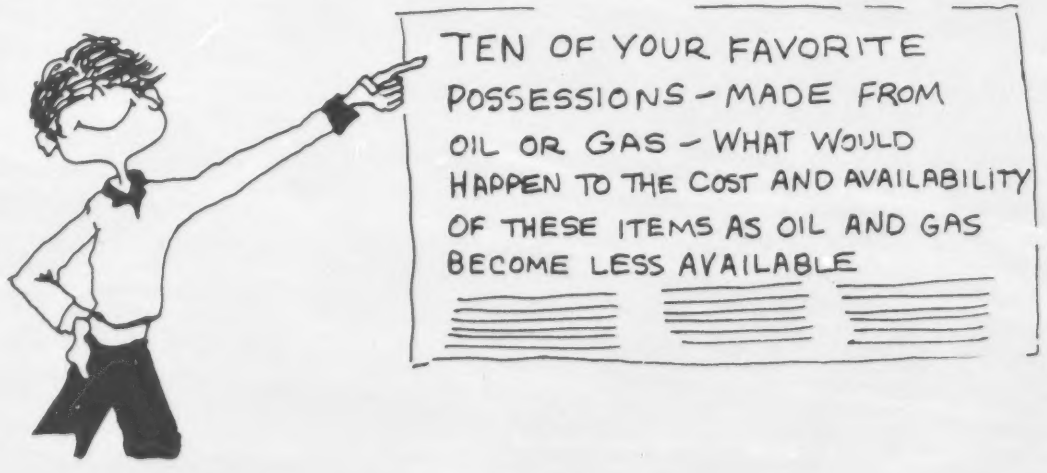
6. Raise the price of the merchandise in the school store at least three times higher. Will the merchandise be conserved? Why? Ask students if all stores charged about the same as the school store, would they conserve the products they bought because of the high prices? Are high prices a good reason for conserving? Why? Why not?

SUGGESTED GRADE LEVEL: 2-9

7. When a resource becomes more scarce, the law of supply and demand forces up the price. When it is too expensive for most users, there is a shift to a replacement resource. The shift from oil and gas to coal for the generation of electric power is an example.

List ten of your favorite possessions that are made from oil or gas (synthetic fibers, plastics) and then discuss what might happen to the cost and availability of these items as oil and gas become less available.

SUGGESTED GRADE LEVEL: 7-12


TEN OF YOUR FAVORITE POSSESSIONS - MADE FROM OIL OR GAS - WHAT WOULD HAPPEN TO THE COST AND AVAILABILITY OF THESE ITEMS AS OIL AND GAS BECOME LESS AVAILABLE



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**concept:** 3 - Attempts to conserve energy interact with economic conditions.

**conservation**

**objective:** 3.3 - The student will understand that maintenance or improvement of environmental quality often requires large capital investment and increased energy use.

# activities

1. Given appropriate examples of capital investment, identify other capital investments.

   SUGGESTED GRADE LEVEL: 4-12

2. Visit and examine nearby industries to determine:
   - how much environmental pollution each contributes
   - how many have made capital investments to decrease their pollution impact
   - what additional capital investments could be made
   - how much capital investment each company has made in the past 10 years toward decreasing environmental pollution

   SUGGESTED GRADE LEVEL: 6-12

3. Visit, if possible, (or view a film) the site of a local strip mine to observe what has been done to restore the land. Find out the costs per acre to restore the land.

   SUGGESTED GRADE LEVEL: 4-12

4. If a 4-foot bed of coal were to underlie your school ground at a depth of 10 feet, would it be profitable to strip mine the coal if the firm had to restore the school ground to its present state?

   SUGGESTED GRADE LEVEL: 10-12

5. Have the students select a site on the school campus and make an architectural plan to landscape it. Obtain a price list from a local nursery and determine costs. Consult with school custodian and principal to find out increases in time and wages to care for the site properly. Determine if the amount of water usage would increase. Evaluate the plan and act accordingly. Is the beauty and change of land usage worth the price?

   SUGGESTED GRADE LEVEL: 4-8

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**concept:** 3 - Attempts to conserve energy interact with economic conditions.

**conservation**

**objective:** 3.4 - The student will identify which personal energy conservation practices require the investment of time and money.

## activities

1. Discuss how recycling paper, jars and cans consumes more time but saves energy in the long run.

   SUGGESTED GRADE LEVEL: 4-12

2. Describe how using less electrical or natural gas energy will save on the monthly utility bill. List those practices which result in less energy usage, e.g. turning out lights, lowering thermostat, using fewer appliances, etc. Explain which of these will consume more personal time and why.

   SUGGESTED GRADE LEVEL: 4-12

3. Explain how changing your personal apparel buying habits may take more time and may cost more, but will save energy, e.g. buying cotton or natural fabric clothes instead of polyester.

   SUGGESTED GRADE LEVEL: 4-12

4. Describe how using a bicycle or mass transportation will consume more personal time but conserve energy.

   SUGGESTED GRADE LEVEL: 4-12

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**concept:** Attempts to conserve energy interact with economic conditions.

**conservation**

**objective:** 3.5 - The student will understand that energy conservation practices may improve the economic position of certain industries, businesses and institutions, and adversely affect others.

## activities

1. Study several different industries, businesses, and institutions to determine how energy conservation practices have affected their economic positions.

   SUGGESTED GRADE LEVEL: 10-12

2. Study a number of industries, businesses, and institutions to determine why some are adversely affected by conservation while other economic conditions are favorably affected.

   SUGGESTED GRADE LEVEL: 10-12

3. Graph the yearly sales of compact import automobiles (Toyota, Datsun, Subaru, Volkswagon, Honda, etc.) for the last decade. Graph the price of regular gasoline per gallon during the same years. Compare graphs. Explain relationships.

   SUGGESTED GRADE LEVEL: 10-12

4. Invite a local insulation contractor to class to explain how energy conservation concerns have affected that company's sales and profits. At the same time, the speaker could demonstrate types of insulation used and discuss their respective benefits.

   SUGGESTED GRADE LEVEL: 4-12

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**concept:** 3 - Attempts to conserve energy interact with economic conditions.

**conservation**

**objective:** 3.6 - The student will understand that energy conservation practices can result in savings or additional cost.

# activities

1. Determine various ways money has been saved in your own house through energy conservation activities.

   SUGGESTED GRADE LEVEL: 4-12

2. Identify energy conservation activities which result in money savings.

   SUGGESTED GRADE LEVEL: 4-12

3. Identify items in the market place which, through energy conservation efforts, are money saving (i.e. fresh vegetables vs. processed vegetables).

   SUGGESTED GRADE LEVEL: 4-12

4. Ask your relatives what kind of heating equipment they use and how much money each household spent last winter for fuel. Compare the relative cost differences. How many of the homes with low costs are insulated? What other characteristics cause cost fluctuations?

   SUGGESTED GRADE LEVEL: 5-9

5. Have the district secure infrared air photos of the district homes. Have your class identify high energy loss structures, map locations, compute percentages, etc.

   SUGGESTED GRADE LEVEL: 6-12

6. Set your home thermostat at $70^{o}$ for one month and record your heating costs. Then set the thermostat at $68^{o}$ and compare the costs. Use the months of January and February if possible.

   SUGGESTED GRADE LEVEL: 6-12

7. Have your relatives do activity #6 also, and compare the resulting figures. Then try to determine which variables other than thermostat temperature settings might cause fluctuations in fuel costs.

   SUGGESTED GRADE LEVEL: 6-12

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# activities

Concept 3
Objective 3.6 (continued)

8. Have the class obtain information about energy usage for the building over a period of time (i.e. three weeks). Record and chart the information for all to see. Have the class set up a conservation program/campaign for the building and continue to monitor and record energy consumption. Compare the results of the present data to the past. Was there a savings in energy use? Was there a savings in money? What will the district do with the money saved?

SUGGESTED GRADE LEVEL: 4-8

9. Have the class develop a survey form to be used to record the amount of fuel their parents' automobile(s) uses over a period of time (i.e. three weeks). Then have the participating students compute the gas mileage average over that period of time. After this has been determined, the student and parent(s) can figure out ways fuel could be conserved. Continue to monitor gas consumption and mileage driven to see if conservation has taken place. During this time, also compute the money saved.

SUGGESTED GRADE LEVEL: 4-8

10. Compare the amount of energy created by a hydroelectric generator and the percentage of that energy which can be delivered for use.

SUGGESTED GRADE LEVEL: 7-9

11. Determine the annual (monthly) energy savings in heating your home at $65^{o}$ rather than $75^{o}$.

SUGGESTED GRADE LEVEL: 7-9

12. Determine the annual (monthly) energy savings from setting your home water heater at $125^{o}$ rather than $160^{o}$ F.

SUGGESTED GRADE LEVEL: 7-9

13. Compare the money and energy saved by using a different system for home heating and cooling.

SUGGESTED GRADE LEVEL: 4-6





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# activities

Concept 3
Objective 3.6 (continued)

14. Determine the money and energy savings, if any, of using small appliances in food preparation instead of the range.

SUGGESTED GRADE LEVEL: 4-6

15. Determine the money and energy savings, if any,
- of installing thermopane/storm windows instead of standard windows.
- of a home with minimal insulation and one with recommended insulation.
- of closing draperies at night and opening during the day.
- of insulating or not insulating a hot water heater in an unheated area.
- of turning off the thermostat at night or turning down to 55°.
- of frequent changes of the thermostat during the day or maintaining a set temperature.
- of insulating or not insulating heating ducts in an unheated space.

SUGGESTED GRADE LEVEL: 4-6

16. Compute the daily kilowatt hour usage and energy costs of some of the appliances in your home.

SUGGESTED GRADE LEVEL: 7-9

17. Develop a slide presentation on home energy conservation. Cover the following topics:
- proper insulation
- kinds of insulation
- storm windows and doors
- weatherstripping on windows or around doors
- caulking compound
- plastic sheeting used for storm windows
- vegetation around house
- proper site orientation of house
- conservation sticker near light switch
- historical demand for household energy
- small car beside large one, with mileage
- 55 mph speed limit sign
- materials (pamphlets, lists) on energy conservation tips

SUGGESTED GRADE LEVEL: 4-12



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# activities

Concept 3
Objective 3.6 (continued)

18. Discuss the consequences (money saved, time saved, etc.) of sharing expenses among neighbors. Discuss such items as:
    - clothing
    - carpool
    - one subscription to the newspaper
    - pets
    - childcare
    - safety
    - community garden
    - recreation facilities

SUGGESTED GRADE LEVEL: 4-12

19. Investigate the apparent excessive use of lighting in commercial buildings at night and compare use with need.

SUGGESTED GRADE LEVEL: 9-12

20. If you live near a rapid-transit system, such as the Monorail in Seattle, go for a ride on it. Write a paper comparing costs of rapid-transit to an automobile.

SUGGESTED GRADE LEVEL: 9-12

21. Should each home deliberately diversify sources of energy, e.g. use gas, electricity, wood in fireplace, oil, etc.? Will this save on costs of fuels? Write a paper expressing your opinions.

SUGGESTED GRADE LEVEL: 10-12





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**concept:** 3 - Attempts to conserve energy interact with economic conditions.

**conservation**

**objective:** 3.7 - The student will understand that the price of a resource is related to its availability and importance to society.

## activities

1. Identify items in the market place that change in cost from season to season; year to year; or month to month.

   SUGGESTED GRADE LEVEL: 4-6

2. Through observation of petroleum product prices, and related information, identify reasons for price fluctuations.

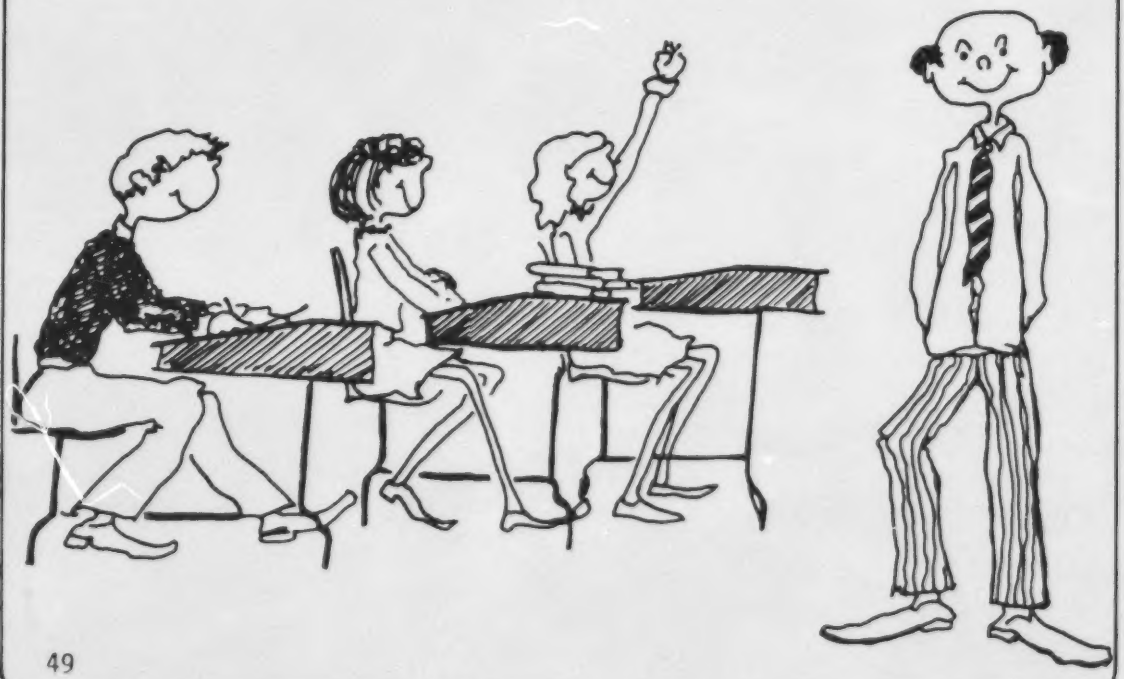
   SUGGESTED GRADE LEVEL: 4-12

3. Identify items which you feel are important to society, to determine if a relationship between price and product exists.

   SUGGESTED GRADE LEVEL: 4-6

4. List societal priorities by identifying energy resources you feel are most important to least important.

   SUGGESTED GRADE LEVEL: 4-6





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**concept:** 3 - Attempts to conserve energy interact with economic conditions.

**conservation**

**objective:** 3.8 - The student will understand that conservation of a resource becomes increasingly important as availability decreases.

**activities**

Concept 3

1. Since oil and natural gas supplies are limited, list and explain ways petroleum products are used in our society (e.g. as fuels, oils, greases, clothes, medicine, transportation, etc.) Make a list of priority uses for petroleum products and natural gas and determine current uses of these products which should be eliminated.

   SUGGESTED GRADE LEVEL: 4-12

2. Discuss how conservation of electricity affects the availability of oil and/or coal.

   SUGGESTED GRADE LEVEL: 4-12

3. Describe how home conservation practices can affect the future availability of coal, oil, or natural gas.

   SUGGESTED GRADE LEVEL: 4-12

4. Discuss how utilization of scarcer resources affects the price, making conservation increasingly important, e.g. drilling deeper and in more remote areas for oil and gas and coal. Also, how abundan resources close to where people live vs. lower quality resources that have to be transported long distances affect costs.

   SUGGESTED GRADE LEVEL: 4-12



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**concept:** 3 - Attempts to conserve energy interact with economic conditions.

**conservation**

**objective:** 3.9 - The student will understand that the economic cost of developing alternative energy sources increases as the availability of existing resources decreases.

## activities

1. Discuss how increasing scarcity of a resource increases the value and price.

   SUGGESTED GRADE LEVEL: 4-12

2. Discuss how the greatly increased price of oil and natural gas in the U.S. might make other sources cheaper to develop.

   SUGGESTED GRADE LEVEL: 4-12

3. Explain the factors which cause oil to cost less in Texas than in Oregon, Maine, or other non-oil producing states. Same for coal and natural gas.

   SUGGESTED GRADE LEVEL: 4-12

4. Compare the transportation costs for oil, coal, natural gas, uranium, geothermal resources.

   SUGGESTED GRADE LEVEL: 4-12

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**concept:** 3 - Attempts to conserve energy interact with economic conditions.

**conservation**

**objective:** 3.10 - The student will understand that regulatory processes can have a positive or negative economic impact on conservation practices.

# activities

1. List and explain the major functions of federal agencies which in some way regulate energy resource exploration, extraction, and utilization.

   SUGGESTED GRADE LEVEL: 7-12

2. Determine the ways a national energy policy would affect regulatory agency processes.

   SUGGESTED GRADE LEVEL: 10-12

3. Determine which forms of energy are used in your home and explain how each is regulated by local, state, or federal agencies.

   SUGGESTED GRADE LEVEL: 10-12

4. Discover the regulations which now control your school lunch program operation. Consider changes in the regulations and standard operating procedures which could secure greater utilization of food by the students and which would produce less food waste. Consider the impact of family-style serving, scrambled cafeteria serving, changes in preparation of specific dishes, participatory menu making, advisory committees of students and parents, etc.

   SUGGESTED GRADE LEVEL: 4-12

5. Invite a representative from a local energy supply firm to discuss the interaction of regulatory processes and conservation practices.

   SUGGESTED GRADE LEVEL: 7-12

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**concept:** 4 - There are various methods to conserve energy.

**conservation**

**objective:** 4.1 - The student will be able to understand the energy use and cost differences of throw-away, recycled, and reusable materials.

## activities

1. Contact the local bottling company and get a cost comparison for reusing glass bottles compared to manufacturing new ones.

   SUGGESTED GRADE LEVEL: 4-6

2. Contact a company which manufactures aluminum cans to find out how much energy is saved by recycling cans.

   SUGGESTED GRADE LEVEL: 7-9

3. Separate the items in your home garbage for one week. Determine some uses for the items that were discarded. Compare the disposal volume requirements for the garbage that is not usable to the items with potential use.

   SUGGESTED GRADE LEVEL: 4-6

4. Identify and locate recycling agencies in your community, i.e. glass, paper, Goodwill. Visit one or have a representative come to talk with the class to discuss the benefits of recycling and reusing items.

   SUGGESTED GRADE LEVEL: 4-6

5. Compare the durability or lifetime of various brands of 100-watt light bulbs.

   SUGGESTED GRADE LEVEL: 4-6

6. Develop a recycling program plan for the school and implement it, if possible. Obtain literature on recycling programs developed at other schools and communities. Some questions that should be answered include:
   - What items (paper, glass, metal) should/can be recycled?
   - What amount (pounds) of the items are generated monthly at the school? At students' homes?
   - Can the school recycling program be part of a community-wide recycling program?
   - Who would sort and collect the items?
   - What dangers are involved in handling the items (i.e., broken glass or aluminum?

(continued)





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Concept 4
Objective 4.1 (continued)

6. (continued)

- What would be used for containers and where would collecting stations be located?
- How often would items be picked up?
- What price would the different items bring? Would the program be cost-effective?
- If glass must be crushed, what safety precautions must be taken?
- Would the school administration support be absolutely necessary?
- How would items be transported from the collecting stations to the recycling center?
- What would be done with revenues received from the recycling program?

CONTACT ORGANIZATIONS:

- Your local or nearest recycling center (see telephone directory).
- National Center for Resource Recovery, 1211 Connecticut Avenue NW Washington, DC 20036.
- National Association of Recycling Industries, 330 Madison Avenue, NY, NY 10017.
- American Paper Institute, Inc., Paper Stock Conservation Committee, 260 Madison Avenue, NY, NY 10016.
- Aluminum Recycling Association, 200 L Street NW, Suite 502, Washington, DC 20036.

SUGGESTED GRADE LEVEL: 7-12

7. Evaluate the merits of garbage sorting vs. total pickup, e.g. separation of fats, metals, bottles, bundles, and other materials, and the feasibility of sorting.

SUGGESTED GRADE LEVEL: 7-12



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Concept 4
Objective 4.1 (continued)

8. Bring to class a six-pack of empty pop bottles. Compute the refund for returning the bottles to the store. This would be a good time to use real money (pennies and/or dimes) so that the amount of money for returning pop bottles can be visually seen and felt. Discuss the importance of returning bottles. (We save money and the pop bottle company saves money and energy, too!) It costs the pop bottle company a lot more energy and money to make new bottles than to reuse returnable bottles.

SUGGESTED GRADE LEVEL: K-3

9. Bring to class a broken toy that can be repaired. Point out the parts that are broken. Discuss whether the toy should be repaired or thrown away. What is the cost difference between buying a new toy and fixing the broken one? Discuss the importance of fixing and reusing broken toys as compared to throwing them away and buying new ones. Don't forget to discuss energy and money savings as a result of fixing and reusing.

SUGGESTED GRADE LEVEL: K-3

10. Bring a small, empty, clean vegetable can to class. Using leftovers and scraps if possible, decorate the cans and reuse them as pencil holders. Compare the dollar cost of a store-bought pencil holder to that of making one with a reused can and materials. Point out the energy and money saved.

SUGGESTED GRADE LEVEL: K-3

11. Locate on a map of your community the firms or centers for the collection of waste or materials which are recycled, e.g. Goodwill Industries, Salvation Army, second-hand stores, auction yards, automobile salvage yards, garbage collection centers, recycling centers, newspaper collection sites, etc.

SUGGESTED GRADE LEVEL: K-3

12. Make a litter monster with three heads for different types of paper waste. Indicate by appropriate signs, colors, designs, etc., which types of paper litter are reusable.

SUGGESTED GRADE LEVEL: K-3



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Concept 4
Objective 4.1 (continued)

13. Have the students read Dear Garbage Man (Scholastic Books) and Just a Box (Scholastic Books). Discuss the value of reusable materials. Encourage students to bring reusable items to class such as plastic bottles, magazines, margarine containers, wrapping paper, etc.

SUGGESTED GRADE LEVEL: K-3

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**concept:** 4 - There are various methods to conserve energy.

**conservation**

**objective:** 4.2 - The student will understand that conservation practices differ in various societies.

## activities

1. Compare the energy requirements for food preservation and preparation in your home with that in one of your classmates' and in other societies.

   SUGGESTED GRADE LEVEL: 7-9

2. Write a pen pal in another country or state and find out if conservation is being practiced. If so, how is it being practiced? How is energy used in your pen pal's home or school?

   SUGGESTED GRADE LEVEL: 4-9

3. Compare the space heating practices and energy requirements in your home to those in the home of a Japanese, German, or family in another culture.

   SUGGESTED GRADE LEVEL: 7-9

4. Compare the per capita level of transportation requirements in Sweden to those in the United States and explain why there are differences.

   SUGGESTED GRADE LEVEL: 7-12

5. Compare the food preparation practices of the U.S. with other societies to determine the most energy-efficient methods.

   SUGGESTED GRADE LEVEL: 7-9

6. Have parents with differing cultural heritages come to school and prepare different styles of food for the class. Discuss the different methods of cooking and decide which seems to require the least amount of energy.

   SUGGESTED GRADE LEVEL: 1-3

7. Describe three types of recycling which reduce littering.

   SUGGESTED GRADE LEVEL: K-12

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# activities

Concept 4
Objective 4.2 (continued)

8. Discuss methods children use to conserve water in the U.S. vs. how children conserve in an underdeveloped nation (parts of Africa, South America, etc.) How have you or how could you cut down on using water at home? Look at pictures of children in an underdeveloped nation and learn how they might reduce their water usage during a drought. Do the conservation practices differ between our two nations? If so, how and why?

SUGGESTED GRADE LEVEL: K-3



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**concept:** 4 - There are various methods to conserve energy.

**conservation**

**objective:** 4.3 - The student will understand that energy resources can be used in a wasteful or unwasteful manner.

# activities

1. Keep track of the number of hours the lights are on in your room for one evening. Defend this as a wise or unwise use of energy.

   SUGGESTED GRADE LEVEL: 4-6

2. Compare the energy cost per mile to operate mass transit buses and private cars.

   SUGGESTED GRADE LEVEL: 4-6

3. Compare the cost and/or savings of using paper towels to that of using cloth towels.

   SUGGESTED GRADE LEVEL: 4-6

4. Compare the cost and/or savings of using paper plates and cups vs. using non-disposable items.

   SUGGESTED GRADE LEVEL: 7-12

5. Identify the advantages and disadvantages of using certain resources for certain end uses: i.e., natural gas for fertilizers vs. home heating; coal for electricity vs. coal-related products; electricity for water heating vs. oil for gasoline vs. petrochemicals.

   SUGGESTED GRADE LEVEL: 7-12

6. Conduct research and contact appropriate organizations to learn more about conserving energy through mass transportation and then prepare plans for your families to use mass transportation.

   SUGGESTED GRADE LEVEL: 7-12

7. Compare the advantages and disadvantages of keeping or purchasing an old car vs. a new car.

   SUGGESTED GRADE LEVEL: 10-12

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# activities

Concept 4
Objective 4.3 (continued)

8. Describe appropriate recycling laws.

SUGGESTED GRADE LEVEL: 4-12

9. Describe how people have been able to convert items which were once thought to be waste to useful functions.

SUGGESTED GRADE LEVEL: 4-12

10. Arrange with the school cook to take your class to the cafeteria after all lunch periods are over to see the amount of food that was wasted. Ask the cook to explain the importance of not wasting food. Suggest ways that plate waste could be reduced. Remember that food is a source of energy for humans.

SUGGESTED GRADE LEVEL: K-3

11. Discuss the importance of turning out the lights when everyone leaves the classroom for recess or lunch. Lights left on waste energy unnecessarily. Decide upon a plan that can be enacted to help reduce the electricity/energy waste. Elect a lights monitor, etc.

SUGGESTED GRADE LEVEL: K-3

12. Take two identical flashlights with new batteries. Operate one flashlight continuously until the glow in the light cannot be seen. Record the total elapsed time in minutes. Simultaneously, operate the second flashlight discontinuously for 15 minute intervals. Time these intervals with an alarm clock. Record the minutes the second flashlight burns until its glow can no longer be seen. Compare the results. Speculate collectively regarding any observable difference. Relate the phenomena to use of finite energy sources--oil, coal, uranium, natural gas, etc.

SUGGESTED GRADE LEVEL: K-3

13. Read Once There Was A Tree to the class. Show a related film illustrating the life story and uses of a tree. Discuss short, intermediate and long range uses of trees and other things. How do conservation practices affect these various resources and uses? (Examples: wood-fire, houses, antiques; rocks-gravel, building material, collectibles, fine jewelry; oil-fuel, drugs, clothing, plastics and so forth.

SUGGESTED GRADE LEVEL: K-3



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**concept:** 4 - There are various methods to conserve energy.

**conservation**

**objective:** 4.4 - The student will understand that the more efficient the conversion process, the less waste.

# activities

Concept 4

1. Compare the BTU value of a ton of coal burned directly and the BTU equivalent of a ton of coal used to produce electricity.

   SUGGESTED GRADE LEVEL: 7-12

2. Compare the energy efficiency of small and large automobiles.

   SUGGESTED GRADE LEVEL: 10-12

3. Compare the energy efficiency of heating a home with electricity and/or natural gas.

   SUGGESTED GRADE LEVEL: 10-12

4. Identify energy efficient ways to use stoves, ovens and other energy consuming appliances.

   SUGGESTED GRADE LEVEL: 7-9

5. Construct a simple food chain and describe how energy is lost as it is passed through the chain.

   SUGGESTED GRADE LEVEL: 7-9

6. Visit the kitchen of a restaurant or hotel and itemize the utensils or equipment that aid in the conversion of one form of energy to another. Design a utensil that will do the same work but which is not as wasteful as that of the restaurant's.

   SUGGESTED GRADE LEVEL: 7-12

7. Compare the "efficiency of conversion" of:

   - 1910 coal plant
   - 1970 coal plant
   - 1970 nuclear plant
   - 1970 MHD
   - 1970 hydro systems

   SUGGESTED GRADE LEVEL: 10-12

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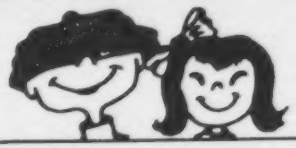

# activities

Concept 4
Objective 4.4 (continued)

8. Draw a bar graph to illustrate and compare the efficiencies of conventional electric steam generating plants fueled by natural gas, coal, oil and uranium with an MHD plant.

SUGGESTED GRADE LEVEL: 10-12

9. Bring to class a lamp with one light bulb and a Coleman lantern. Make the room as dark as possible and compare which source of light is the most efficient when demonstrated. We use light bulbs today instead of lanterns because they are more efficient, and create less waste and pollution.

SUGGESTED GRADE LEVEL: K-3

10. Compare two types of systems for the conversion of energy.

    1) Obtain a hand-operated meat grinder. Show how in a single step the conversion is made from human energy to mechanical energy.

    2) Show how there is a change (conversion) from electrical energy to the heating of water in a stoppered flask to the steam coming out of a rubber hose and turning a small paddle wheel. If possible, have a steam valve on the rubber hose that can be opened or closed in order to show how steam can be controlled to run the paddle wheel.

SUGGESTED GRADE LEVEL: 4-6



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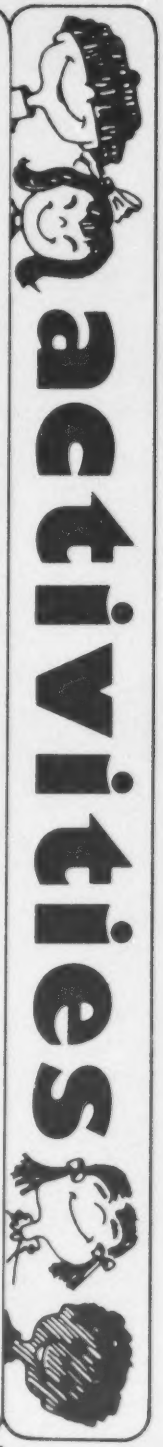
**concept:** 4 - There are various methods to conserve energy.

**conservation**

**objective:** 4.5 - The student will understand that consumption of natural resources can alter options available to future generations.



**activities**

Concept 4

1. Discuss changes in the following:
   - homes
   - jobs
   - mobility
   - lifestyles
   - food production

   if electricity could no longer be supplied from a single point.

   SUGGESTED GRADE LEVEL: 7-12

2. Given the situation that the available oil has been depleted, design subsequent transportation systems.

   SUGGESTED GRADE LEVEL: 7-12

3. Design a plan which will restore a community's depleted water supply.

   SUGGESTED GRADE LEVEL: 10-12

4. Develop a plan for improving the depleted soil of a farming community: Among the techniques which can be considered are:
   - cover crop/green manure
   - contour plowing
   - crop rotation
   - strip cropping
   - fallowing
   - soil conditioning

   SUGGESTED GRADE LEVEL: 7-12

5. Discuss why it is important to preserve waste materials that contain scarce elements or minerals for recovery at a future time.

   SUGGESTED GRADE LEVEL: 4-9

6. Write a short story explaining what the earth will be like in the year 2000 in terms of energy resources.

   SUGGESTED GRADE LEVEL: 4-12



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# activities

Concept 4
Objective 4.5 (continued)

7. Bring a favorite toy to class to share. After sharing, decide if your toy is made of wood, metal or plastic. Place your toy in front of the room in either the pile for woods, or metals, or plastics. Your toys are made of a natural resource that comes from under or on top of the ground. If all the wood, metal, and plastic was used up to make things for the people of today, what would people of the future use to make toys? The teacher should stress the importance of people conserving the earth's natural resources so that future generations can have them, too.

   SUGGESTED GRADE LEVEL: K-4

8. Collect the waste paper in the classroom for a week. Observe and talk about the amount of paper you are using. If we waste too much paper today, what will happen to the paper supply people have in the future? How can paper waste be reduced in your classroom?

   SUGGESTED GRADE LEVEL: K-4



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**concept:** 4 - There are various methods to conserve energy.

**conservation**

**objective:** 4.6 - The student will understand that the volume of personal, agricultural, and industrial waste can be reduced.

# activities

1. Compare the amount and type of packaging used in selling specified grocery items in bulk (at a community food co-op) vs. convenience packaging. Analyze the net energy used in the production of the packaging materials.

   SUGGESTED GRADE LEVEL: 9-12

2. Count the containers thrown away while unpacking groceries at home. Discuss what can be done to cut down on unnecessary packaging.

   SUGGESTED GRADE LEVEL: K-3

3. Compose a letter to your local post office requesting that "junk mail" not be delivered.

   SUGGESTED GRADE LEVEL: 7-12

4. Bring in a discarded object from home and design a useful purpose for it.

   SUGGESTED GRADE LEVEL: K-6

5. Visit the supermarket and identify ways of eliminating, reducing, or changing packaging.

   SUGGESTED GRADE LEVEL: 4-6

6. Research how waste products are being converted to useful products:
   - reading resource materials
   - contacting local companies

   SUGGESTED GRADE LEVEL: 7-12

7. Plan a low net-energy farm operation and identify farm operations that could be improved by more efficient use of energy resources. Identify how to accomplish those operations with a lower energy input. Describe the problems inherent in doing this.

   SUGGESTED GRADE LEVEL: 10-12

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# activities

Concept 4
Objective 4.6 (continued)

8. Bring one or two old toys to school that you are not using anymore. Discuss what can be done with the toys in a useful way rather than throwing them away (i.e. donate them to Goodwill, local fire department, exchange with another student, develop a game center in class, etc.)

SUGGESTED GRADE LEVEL: K-3

9. In conjunction with a dental health unit, ask someone in the class to demonstrate that only one or two small glasses of water are required to brush teeth and clean up. A great deal of water is saved when this method is used in comparison to letting the water run down the drain.

SUGGESTED GRADE LEVEL: K-3

10. Discuss how you might reduce waste at your school with the following:
- drinking fountain
- school paper
- sharpening pencils
- washing hands
- lights
- other

SUGGESTED GRADE LEVEL: K-3

11. Visit a site which uses garbage to produce heat/gas or other energy for the community as opposed to allowing the waste to collect.

SUGGESTED GRADE LEVEL: K-3

12. Take a field trip to a farm (industry) to discuss how it utilizes "waste" materials, e.g. manure, crop stubble, etc.

SUGGESTED GRADE LEVEL: 7-9

13. Visit a restaurant or store to determine how they utilize their waste.

SUGGESTED GRADE LEVEL: 4-6



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# activities

Concept 4
Objective 4.6 (continued)

14. Contact a major lumber-industrial firm to obtain a speaker and material. Study and discuss ways they use lumber waste materials to manufacture useful goods.

SUGGESTED GRADE LEVEL: 4-6

15. Ask the custodians to pile the previous day's waste paper and similar "clean" garbage in a central location to emphasize the massive quantities of waste produced by a single school.

SUGGESTED GRADE LEVEL: K-3

16. Have the students make litter bags and design posters to place on school bulletin boards to promote their use.

SUGGESTED GRADE LEVEL: K-3





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**concept:** 4 - There are various methods to conserve energy.

**conservation**

**objective:** 4.7 - The student will understand that placing the "true energy cost" on manufactured items could reduce waste.

## activities

1. Compare the packaging procedures and costs in a MacDonald's restaurant and those of a standard restaurant. List ways packaging waste could be reduced in each situation. (Discuss why restaurants package food the way they do. Be sure to research state and federal laws.)

   SUGGESTED GRADE LEVEL: 7-12

2. Research and compare the cost of an aluminum can manufactured in the U.S. and one produced in another country. Why the difference in price? What is the "true energy cost" of the can produced in the U.S.?

   SUGGESTED GRADE LEVEL: 10-12

3. Visit a sanitary landfill. Adopt your own piece of trash. Consider it your pet. Groom it for classroom display. Then determine the present retail price of your pet. Investigate the pedigree of your pet trash by contacting an appropriate supplier, distributor, manufacturer, etc. Estimate as closely as possible the total energy cost of the object. Remember to include cost to transport and dispose of your pet in the sanitary landfill. Are there ways to reduce the "true energy cost" of your pet?

   SUGGESTED GRADE LEVEL: 4-12

4. Contact a local agriculturalist and have h/er explain to you h/er total unit cost for the specialty product produced. Upon your return to class, share your collective discoveries.

   SUGGESTED GRADE LEVEL: 10-12

5. Discuss the reasons for pop bottle companies reusing empty bottles. Why don't they throw them away and make new ones?

   SUGGESTED GRADE LEVEL: K-3

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**concept:** 4 - There are various methods to conserve energy.

# conservation

**objective:** 4.8 - The student will understand that economic, political, and regulatory actions can encourage or discourage the practice of energy conservation.

## activities

1. Identify which government agencies regulate conservation practices.

   SUGGESTED GRADE LEVEL: 7-9

2. Trace the history of government regulation of the consumption of natural gas (contact the public information director of your local gas company).

   SUGGESTED GRADE LEVEL. 10-12

3. Contact your congressman to determine what energy legislation is currently being considered.

   SUGGESTED GRADE LEVEL: 7-9

4. List advantages and disadvantages of government regulation of energy sources.

   SUGGESTED GRADE LEVEL: 10-12

5. Contact various civic, environmental, and conservation organizations across the state to determine whether they have energy conservation programs and the nature of them. Some questions for students include:
   - What kinds of energy conservation programs are sponsored by citizen groups?
   - For what target groups have the energy conservation programs been developed?
   - How effective have citizen groups been as advocators of energy conservation?
   - How can you participate in these groups? How can you help develop programs?
   - Are most of the citizen groups in your state actively committed to energy conservation?
   - What industries would you expect to give their attention to selling more energy rather than seriously promoting conservation?

   SUGGESTED GRADE LEVEL: 7-9

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# activities

Concept 4
Objective 4.8 (continued)

6. Can you recall when your family could not use water at home for the lawn and washing cars on certain days of the week? If so, why do you think this regulation was enforced and who do you think made the regulation?

SUGGESTED GRADE LEVEL: K-6

7. Collect (obtain complimentary copies or borrow from the school library) at least 20 energy publications. Then break down into teams of 5 members each. There should be 5 to 7 "Material Review Teams." Before reviewing and evaluating documents, develop special criteria which include reading level, objectivity, cost, etc. Answers should be obtained to the following questions:
   - Who (person/agency) designed and/or funded the study and for what purpose?
   - Did the author(s) make any general assumptions or take things for granted?
   - Did the author(s) clearly state how data were obtained and how conclusions were reached?
   - Did the author(s) conduct the study to further support an action (or opinion) which had already been decided upon at an earlier date by an agency or special interest group?
   - Did the author(s) ask biased questions in order to obtain the answers needed to support the views of a special interest group?
   - Did the author(s) double-check data for accuracy?
   - Were sources of data or information used in the study reliable, accurate, and up-to-date?
   - How did the author(s) look for, describe, and select from alternatives when arriving at the solutions or conclusions?
   - Did the author(s) look thoroughly into the environmental, economic, and social aspects of the problem?
   - Did the author(s) attempt to define energy terms? How do definitions compare among authors?

   The composite findings of all teams should be used to compile an Energy Education/Conservation Bibliography for students.

   Contact organizations: Additional resources can be obtained from:

   - Your state's energy office
   - U.S. Department of Energy, 12th & Pennsylvania Avenue, NW, Washington, DC 20461
   - Oak Ridge National Laboratory, P.O. Box X, Oak Ridge, TN 37830
   - Center for Energy Information, 340 East 51st Street, New York, NY 10022



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**concept:** 4 - There are various methods to conserve energy.

**conservation**

**objective:** 4.9 - The student will understand that energy can be conserved in homes, schools, industries, and communities.

# activities

1. Interview the manager of a hardware or appliance store to determine what methods (messages/devices) are being used to convey the energy conservation message.

   SUGGESTED GRADE LEVEL: 7-9

2. Organize a program to train students how to conduct home energy audits.

   SUGGESTED GRADE LEVEL: 10-12

3. Organize a speaker's bureau of both experts and laymen who will voluntarily make energy conservation presentations.

   SUGGESTED GRADE LEVEL: 7-9

4. Determine if it is possible to still pay higher utility bills after implementing an effective energy conservation program at home. If so, why?

   SUGGESTED GRADE LEVEL: 10-12

5. Begin an Energy Resource Center (ERC) for the school. Place it in the library or classroom. This project would require at least one semester--perhaps an entire school year. Some tasks would include:
   - Compile a bibliography of available school and community print and nonprint materials on energy.
   - Provide copies of a current listing of institutions and agencies which can provide information on energy.
   - Write to local, state, and federal agencies requesting information on energy.
   - Compile a list of community leaders who can speak on energy topics.
   - Make energy information available to students, teachers, parents and community members.

   SUGGESTED GRADE LEVEL: 7-9

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# activities

Concept 4
Objective 4.9 (continued)

6. Divide into groups of five. Each group should be responsible for preparing one article on ways to conserve energy. The article could be published in the school paper, sent to the editor of a local newspaper, or submitted to the manager of a television station. Two students from the class should edit all the articles, seeing that each article is as objective as possible, and supervise printing and dissemination. Articles should deal with such topics as:
   - The Energy Problem--Is it Real?
   - Government's Response to the Energy Crisis
   - The Heat Pump
   - Solar Water Heating
   - Night Setback of Thermostats
   - The Role of Education in Solving the Energy Problem
   - The Community Response to the Energy Crisis
   - Criteria for Siting Nuclear Power Plants
   - Energy Myths
   - Energy Conservation and Transportation
   - Environmental Problems Caused by Energy Development

   Answer the following questions in class:
   - Do citizens have adequate access to energy conservation information?
   - What is the role of media in solving the energy problem?

   SUGGESTED GRADE LEVEL: 4-12

7. Prepare a comprehensive listing of every electrical household appliance you can think of. Each student (or team) should select an appliance, compile a complete portfolio of advertisements and marketing campaigns for it, and examine these materials carefully, especially with regard to the "truth in advertising" requirements. Discuss the following topics:
   - Legislation, if any, that applies to the appliances, such as energy efficiency ratings, care and maintenance instructions, and warranties.
   - Advantages and disadvantages of the appliance, with regard to energy consumption.
   - The amount of energy required to manufacture the appliance.
   - The amount of energy and cost of operating the appliance.
   - Its survival value in the family's lifestyle.
   - Whether the appliance is a "status item" and why.
   - The extent to which the appliance could adversely affect cultural and social patterns (e.g. television and crime).
   - Similar appliances by different manufacturers.
   - How does advertising and marketing affect buying patterns? Is it worth it to you as a consumer?

   SUGGESTED GRADE LEVEL: 10-12



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# activities

Concept 4
Objective 4.9 (continued)

8. Develop and implement a school energy and materials conservation advertising program.
   - Posters
   - Buttons
   - T-shirts
   - Plays
   - Radio/TV
   - Newspaper ads

   SUGGESTED GRADE LEVEL: K-6

9. Save all packaging materials from your family's goods for a period of one day. Suggest alternative packaging methods for as many items as possible, considering the following:
   - biodegradability
   - efficiency of product use
   - aesthetics

   SUGGESTED GRADE LEVEL: 3-8

10. Check your family's utility bill for a specific month to determine the number of kWh used that month last year. If you no longer have the bill, find the cancelled check or receipt from the utility company for that month. Your utility company can tell you how much it charged per kWh for that period. (TEACHER NOTE: Ask one person from the class to call the utility company for this information.) Ask for the family to conserve electricity by all means possible for that month this year. Compare the kWh for the two years to determine the amount of savings. Provide for the variables of degree days, added energy-using devices during the year, and daylight intensity.

    SUGGESTED GRADE LEVEL: 4-12

11. Pretend your school is a modern one with large windows, plenty of overhead lights, and is even air conditioned. Everything seems to be going along nicely until one day an area-wide power shortage is announced. Plan for this reduction of the use of electrical energy in the school. What alternatives can be suggested? What reasons support and oppose each alternative?

    SUGGESTED GRADE LEVEL: 4-12





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# activities

Concept 4
Objective 4.9 (continued)

12. An ordinance has been passed ordering all users of electric energy to reduce their use by one-half. Explain what you will choose to do without and why.

SUGGESTED GRADE LEVEL: 4-12

13. Calculate the electric energy that might be saved in one year if your home were to discontinue using each of the following electric appliances:
- toothbrush
- toaster
- hot water heater
- freezer
- lights - incandescent and fluorescent
- resistance electric heating
- air conditioning
- radio
- television
- range
- dishwasher
- rotisserie
- radar range (microwave oven)

SUGGESTED GRADE LEVEL: 10-12

14. Conduct a survey of an assigned area in your community, using the survey form on the next page. Organize others to help you analyze and present the results to others in your class or school.

SUGGESTED GRADE LEVEL: 6-12



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# activities

Concept 4
Objective 4.9 (continued)

| YES | NO | UNDECIDED |
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a. Are wastes treated?

b. Does your community have a waste-treatment plant?

c. Is your waste-treatment plant primary?

d. Is your waste-treatment plant secondary?

e. Is your waste-treatment plant tertiary?

f. Do industries dump their wastes into the community treatment plant?

g. Do industries bypass your community's waste-treatment plant and dump their wastes into local water sources?

h. Do industries dump their untreated wastes into local water sources?

i. Do homeowners dump their untreated wastes into local water sources?

j. Do businesses dump their untreated wastes into local water sources?

k. Is some waste bypassed into local water sources during normal dry weather?
   a) What %_____
   b) How often_____

l. In wet weather, when lines and plants may be taxed by storm flow, is some sewage bypassed into local water sources?
   a) What %_____
   b) How often_____

m. Does your waste-treatment plant have enough employees to operate it efficiently on a 365-day basis?





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# activities

Concept 4
Objective 4.9 (continued)

| YES | NO | UNDECIDED |
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n. Does your waste-treatment plant plant have enough employees to operate it efficiently on a 24-hour basis?

o. Is a training program provided for waste-treatment operators in your community?

p. Does your waste-treatment plant provide on-the-job training?

q. Is your training program paid for by the community?

r. Is your treatment plant up to date?

s. Does your community require connection to a public waste-treatment plant?
   a) How many sewer pipes are not connected with a waste-treatment plant?_____

t. Does your community prohibit its sewer system from being connected with storm water drains?

u. Does your community have a sewage treatment problem?



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# activities

Concept 4
Objective 4.9 (continued)

15. Visit a local industry and survey the extent of its energy conservation techniques.

SUGGESTED GRADE LEVEL: 4-12

16. Set up a model Research and Development group in your classroom to determine procedures to save energy in your school.

SUGGESTED GRADE LEVEL: K-12

17. Invite someone from a local industry's Research and Development Department to visit your class to discuss alternate strategies for energy consumption in that industry.

SUGGESTED GRADE LEVEL: 4-12

18. Have all sources of power to the classroom turned off. Discuss those sources which are absolutely necessary to the school. Discuss alternate sources which contribute less pollution that might be substituted for those presently in use.

SUGGESTED GRADE LEVEL: 3-12

19. Contrast the use of rapid transit systems with automobile use by individuals.

SUGGESTED GRADE LEVEL: 4-12

20. Compare the energy savings of space heating from a central station system on a university campus or some local government buildings to alternate methods of space heating units for individual buildings. Some things to consider:
    - Determine the floor space and ceiling heights of the buildings.
    - Determine the annual building space heating costs per square foot and compare.
    - Consider thermostat settings in the buildings.

SUGGESTED GRADE LEVEL: 10-12





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# activities

Concept 4
Objective 4.9 (continued)

21. Collect photographs of abandoned buildings and draw up plans for their redesign and remodeling (include systems for dismantling and transporting to new locations if necessary.)

SUGGESTED GRADE LEVEL: 4-12

22. Collect cast-off industrial packing (styrofoam, crates from motorcycles, electrical appliances, etc.) and use as a materials source to construct sculptural forms. (Styrofoam can be easily cut with a hot wire.)

SUGGESTED GRADE LEVEL: 3-12

23. Design a community-agricultural complex that would utilize waste heat from an electrical or industrial complex.

SUGGESTED GRADE LEVEL: 10-12

24. List and describe three ways an industrial plant could minimize or eliminate waste-heated water discharge to a river.

SUGGESTED GRADE LEVEL: 10-12

25. Describe how industrial plants could be designed to increase profits and simultaneously reduce or eliminate air and water pollution, i.e., process and sell the effluents.

SUGGESTED GRADE LEVEL: 10-12

26. Visit a pulp and paper plant. Discuss the methods of trapping possible pollutants and how these materials are either used or disposed of.

SUGGESTED GRADE LEVEL: 7-9



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# activities

Concept 4
Objective 4.9 (continued)

27. List ways the lumber industry uses the sawdust it once disposed of by burning. Determine what economic benefits have been derived from the use rather than disposal of sawdust.

SUGGESTED GRADE LEVEL: 7-12

28. Research communities in which garbage is "recycled" and show the resulting benefits to that community.

SUGGESTED GRADE LEVEL: 4-12

29. Make a tally of cars and record the number of people per car. Suggest ways to conserve.

SUGGESTED GRADE LEVEL: 5-12

30. Record the number of trips made in the family car in one week. Record the destination, the distance, and the number of passengers. Can you cut down?

SUGGESTED GRADE LEVEL: 4-12

31. Map the area in which you live and show the bus stops and routes which you can use to travel to your usual destination.

SUGGESTED GRADE LEVEL: 4-12

32. Design packaging for one specific product which is more energy conserving than the present packaging.

SUGGESTED GRADE LEVEL: 4-12





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# activities

Concept 4
Objective 4.9 (continued)

33. Record items used in school and home which are disposable and could be replaced by nondisposable items.

SUGGESTED GRADE LEVEL: 4-12

34. Count number of students driven to school and record number of persons per car.

SUGGESTED GRADE LEVEL: 4-12

35. Start a car pool by neighborhoods.

SUGGESTED GRADE LEVEL: 4-12

36. Write a proposal for a bicycle safety program and ask to read the proposal before your City Council.

SUGGESTED GRADE LEVEL: 4-8

37. Select a product, such as a paper bag, and record the number of times you use it. List ways to reuse it.

SUGGESTED GRADE LEVEL: K-12

38. Identify energy-using devices in the home, and describe what changes would take place if any or all were not used.

SUGGESTED GRADE LEVEL: K-3

39. Lead a discussion on the effects of litter and then take the class on a litter patrol walk. Return to class and debrief.

SUGGESTED GRADE LEVEL: K-3



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Concept 4
Objective 4.9 (continued)

Conduct a class bottle and can drive. As a group, deliver the containers to a local store and sell them. Later, visit the store when the delivery trucks from the bottling plants collect the cans. Tour the storage area at the store. Continue on to the soft drink bottling plant to watch the recycling process continue. The teacher should insert appropriate career education, economic and distribution concepts into the post-tour discussion.

SUGGESTED GRADE LEVEL: K-3

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CONCEPT 5

**concept:** 5 - Social and political institutions influence the practice of energy conservation.

**conservation**

**objective:** 5.1 - The student will understand that the conservation of the earth's energy resources depends upon human decisions.

**activities**

Concept 5

*1. Using the following form, write a series of scenarios, plays, short stories, comedy sketches, personal essays, or similar materials which illustrate the particular values and assumptions which influence human decisions about energy conservation practices.

ENERGY USE SITUATIONS

Assume you are in a position to considerably influence energy consumption patterns in your community:

Would you limit energy use? In what ways? Why? What factors would you consider?

What provisions would you make for the elderly on fixed incomes? The unemployed? The sick?

What special considerations, if any, would be given to hospitals? To schools? To public office buildings? To jails?

Assume you hold a political office and have the power to influence decisions on energy use:

How would you reach decisions? How might they be put into effect?

Would one group of citizens receive more attention than the others? Why?

What factors would influence your decisions? Wealth? Power? Knowledge?

Would you make unpopular decisions? Why? State an example.

Assume you are in a position to assist in recreational planning for your community:

Would you give consideration to having athletic events only during daylight hours? What problems would you encounter?

What areas near major concentrations of people could be utilized for parks?

Would bicycle trails throughout the city be popular? Could you suggest a location for a bicycle trail?

*ALL OF THE ACTIVITIES UNDER ACTIVITY #1 ARE SUGGESTED FOR GRADES 10-12.



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# activities

Concept 5
Objective 5.1 (continued)

Assume you are in a position to determine the location of street lights in your community:

Are there locations in which you would add lights for safety or security reasons? Where are they?

Are there locations in which you would eliminate lighting? Where are they? Why?

Are there types of lighting that require less electricity than others? What kinds of lights last the longest period of time? Justify the reasons for using different types of lights at different places.

Assume you are in a position to promote mass transit in your community:

Where would you encourage special bus, van, or carpool lanes? What criteria would you use in deciding their locations?

Are there adequate areas to park cars so individuals could then take part in mass transit? What are these areas?

Where would you obtain the funds to start your program?

Assume you are owner/manager of a grocery store in your community:

Are there items you, as an energy conservationist, would not sell, knowing your personal income might be reduced? Explain.

Are there items you would not sell because of the energy used in packaging? What are the alternatives to packaging?

What other ways could you promote the conservation of energy at your grocery store?

Assume you are going to purchase a family automobile:

What type of automobile would you buy? Why?

Would you buy a new or used automobile? Why?

On what basis would you choose options (radio, air conditioning, power steering, power windows, etc.)?

What effect do you think the new anti-pollution systems have on gas mileage or engine efficiency? What is the effect of running an air conditioner on mileage?



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# activities

Concept 5
Objective 5.1 (continued)

Assume you are in a position to give a homeowner in your community an award of $100 for energy conservation:

What energy conservation features would you look for on the exterior of the home?

What energy conservation features would you look for on the interior of the home?

How does the homeowner's lifestyle contribute to energy conservation?

Assume you have been asked to develop an advertising campaign on energy conservation for your community:

Would there be different approaches for different segments of the community? What would they be?

What types of programs would you develop for television, radio, and newspapers?

Where would you go for assistance (information, manpower, money, etc.)?

Assume you are in charge of transporting coal from the mine to a power plant:

What type of transportation would you use (roads, a river, and railroads are all available)? Why?

What social factors would be considered in your decision?

What environmental factors would be considered in your decision?

Assume you are in charge of operating a strip mine operation:

What would you do to reclaim stripped land? Why?

How would you deal with citizen objections to your operation?

What type of reclamation laws are now in effect? To what extent are they enforced? Who (what agency) is responsible for enforcement?

Assume you are an automobile salesperson:

How would you describe the air pollution controls on the new models? (See driver's manual of a new car.)

What energy conservation tips would you offer?

Would you feel any obligation to lead your customers to an energy-conserving model?





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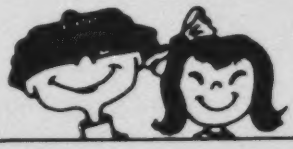

# activities

Concept 5
Objective 5.1 (continued)

Assume you are interested in promoting solar energy technologies (or hydroelectric facilities, conventional nuclear power plants, coal-fired steam plants, or liquid metal fast-breeder reactors) in your state:

Where would you go for assistance?

What type of opposition might you encounter? Why?

Are there any solar demonstrations in your state?

How would you inform citizens about your energy choice?

Assume you are mayor of your city and, in attempting to get more citizens in decision-making situations, are going to establish a citizen's advisory committee on energy conservation:

What type of individuals (educational background, occupations, political philosophy, age, experience, and wealth) would you choose? How many individuals would you choose? Why?

What problem areas would you assign this committee?

What responsibilities would the committee have? How much decision-making power?

Assume you want to live in a simple, uncomplicated, and less consumptive lifestyle:

Where would you establish your home? Why? Where would you not live and why?

How would you support yourself?

In what ways would you use less energy?

What kind of home would you buy or build?

Assume you are designing an apartment complex in your community:

Is there a site that could result in saving transportation costs for the prospective residents? Where?

What type of recreational facilities could be developed on this site to encourage residents to stay home during leisure hours?

How could the apartments be designed and situated (oriented on the site) to conserve energy?



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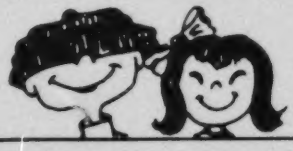

# activities

Concept 5
Objective 5.1 (continued)

Assume you are looking for a way to store additional amounts of frozen food:

Would you buy an upright or chest-type freezer? Which conserves the most energy? What would be advantages and disadvantages of having your own freezer?

Is freezer locker space available in your community? Where? Would you conserve energy by storing food this way? What would be the advantages and disadvantages of using this system?

Assume you are buying a water heater for your home:

Where would you place the heater? Is the location important? Why?

What is the quick recovery system on a water heater? Is it possible to disconnect this system? Why would this be done?

How often should you drain the water heater? Why?

Assume you are a state legislator preparing a bill introducing a state energy policy:

What energy conserving measures would you include and why?

What would be the major steps you would have to follow in order to get the bill passed by the legislature?

Could your state policy affect operational procedures of a federal agency like the Tennessee Valley Authority? How?

Assume you are buying tires for your automobile:

What are the advantages/disadvantages of bias ply tires? Radials?

Does the speed at which you drive affect the lifetime of tires?

Assume you are on the Board of Directors of the hydroelectric power authority in your state and must approve the site of a nuclear or coal-fired power plant:

What economic factors would you consider?

What social factors would you consider?

What environmental factors would you consider?

What other kinds of data or information would you want in order to make your decision?





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# activities

Concept 5
Objective 5.1 (continued)

Assume you, a consumer, are about to buy some clothing:

Would you want synthetic (e.g., polyester) material? Why? Why not? How much energy is required to produce it? To maintain it?

Would you want natural (e.g., cotton) material? Why? Why not? How much energy is required to produce it? To maintain it?

Assume you, a consumer, are purchasing a television set:

What size set would you buy? Why?

Would you buy a black-and-white or color set? Would you buy a tube set or solid-state set? Which ones utilize the most energy? Why?

If you had unlimited funds, how many television sets would you have in your house? Why?

Assume you are the fleet manager for a large governmental agency or private firm:

What type of vehicles would you purchase? Why?

What options would you consider for vehicles in the fleet?

In what ways would you encourage drivers to conserve energy? How could you enforce energy conservation?

Assume you are the manager of an apartment complex:

How would you encourage tenants to conserve energy?

In what ways could energy be conserved in maintenance of the apartments?

What energy conserving actions would you take in the public areas of the complex?

Assume you are going to insulate your house:

What are the most important areas of the house to insulate?

What insulation materials would you use and why?

How is the effectiveness of insulation specified on the material?

Within what time period could the insulation pay for itself in lowered utility bills?



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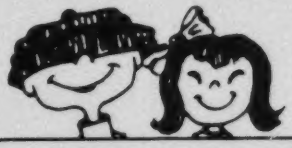

# activities

Concept 5
Objective 5.1 (continued)

Assume you are remodeling your present home:

Where would you place new lights and why?

Where would you use fluorescent light fixtures? Why?

Where could you reduce wattage and size of lights?

Assume you are planning a vegetable garden:

What would you plant and why?

How could you conserve energy in gardening? In canning or freezing your own foods? In cooking?

Assume you are a planner for the State Department of Transportation:

Would you encourage mass transit? Why? How?

How should highways be designed to conserve energy? For safety?

Would you recommend a right turn on red after stop? Why?

What would you want the speed limit to be on interstate highways?

SUGGESTED GRADE LEVEL: 10-12

2. Set up a class discussion in which members of the class debate the various administrative and congressional measures designed to meet the energy crisis.

SUGGESTED GRADE LEVEL: 10-12

3. List the arguments favoring nuclear energy over other sources in or near population centers (so that the excess heat produced by the plant can be used by the community). Research what other countries--England, France, etc. --have done in this regard.

SUGGESTED GRADE LEVEL: 10-12

4. Construct a model city council in class and then testify before that body about the need for ordinances which will control the construction and abandonment of gas stations.

SUGGESTED GRADE LEVEL: 4-12





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# activities

Concept 5
Objective 5.1 (continued)

5. There are about 100,000,000 motor vehicles in the United States. Most of the vehicles are for personal use. Pretend you are going to write a law which restricts the use of personal autos to reduce fuel consumption. What will you say in the law?

SUGGESTED GRADE LEVEL: 4-12

6. Give examples of resources which can last indefinitely if wisely used (renewable).

SUGGESTED GRADE LEVEL: 4-12



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**concept:** 5 - Social and political institutions influence the practice of energy conservation.

**conservation**

**objective:** 5.2 - The student will understand that actions and events influence, extend, or exhaust available energy resources.

# activities

1. Each member of the class brings some object from h/er room or home that s/he considers to be of no further use. Have the class organize and conduct a flea market, and compute the energy and economic savings effected.

   SUGGESTED GRADE LEVEL: 7-12

2. Visit a second hand store, pawn shop, flea market, auction, garage sale, Goodwill, Salavation Army and discuss as a group the social and economic implications of these recycling activities.

   SUGGESTED GRADE LEVEL: 10-12

3. Tour a bottling plant and determine what recycling techniques are being used.
   - Ask their opinions on Oregon's bottle bill.
   - Compare with printed testimony presented to Congress using House and Senate committee reports available in your library.

   SUGGESTED GRADE LEVEL: 7-12

4. Discuss what is meant by a convenience product. Tabulate the names of convenience products that are advertised on television during a 30-minute period. List the possible effects on the viewer. Have students list the convenience products used in their homes. Discuss and list possible impacts on our energy reserves. What are the alternatives to the use of convenience products (packaging)? Create posters to illustrate. Caption them with appropriate conservation slogans.

   SUGGESTED GRADE LEVEL: 4-12

5. Explain the significance of the graph depicting U.S. utilization of fuels 1850 - 1971 (next page). What information about energy sources is missing and what implications involving conservation or changes in lifestyle are implied?

   SUGGESTED GRADE LEVEL: 10-12

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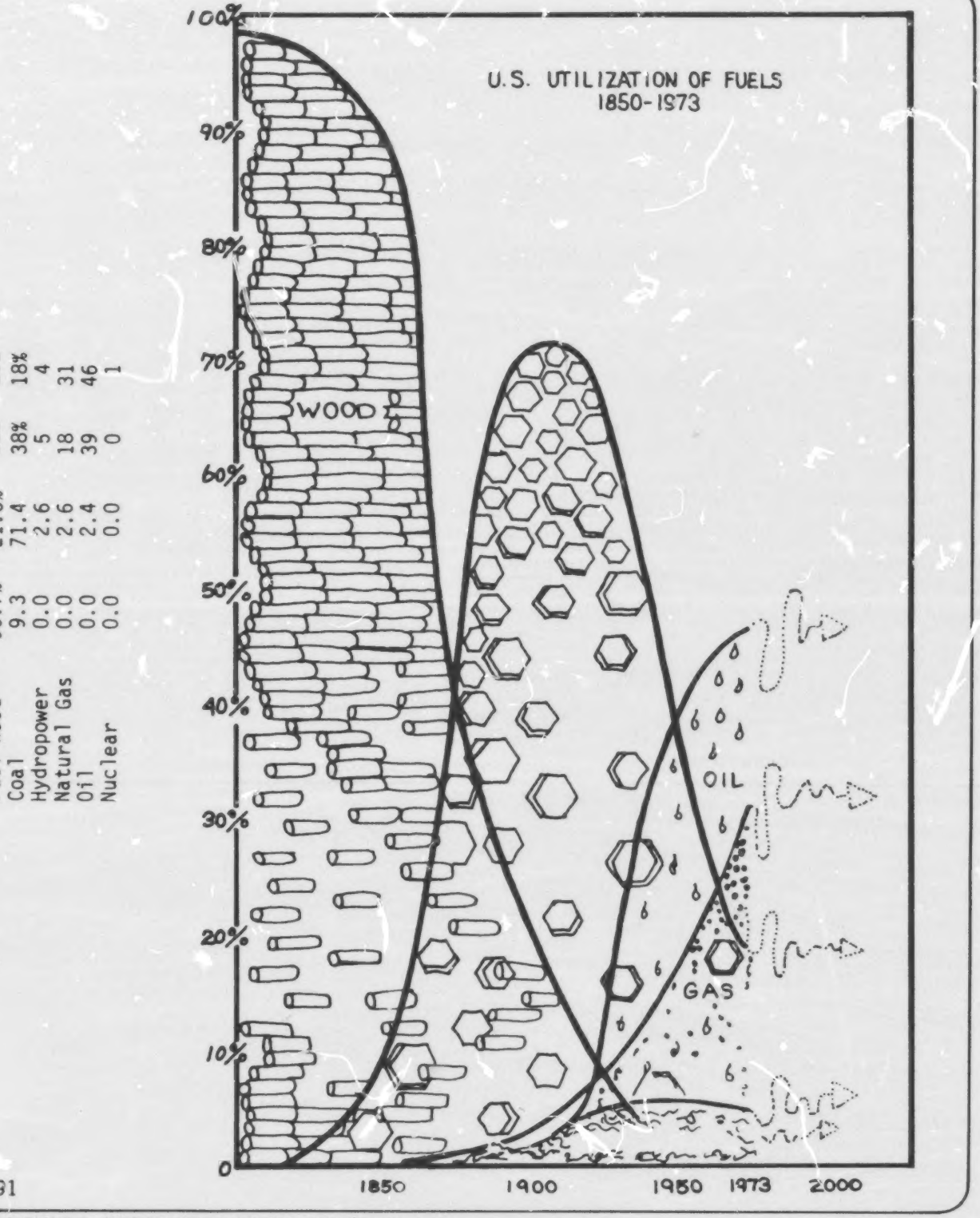
# activities




| | | | | |
|---|---|---|---|---|
| Fuel Wood | 90.7% | 21.0% | --- | --- |
| Coal | 9.3 | 71.4 | 38% | 18% |
| Hydropower | 0.0 | 2.6 | 5 | 4 |
| Natural Gas | 0.0 | 2.6 | 18 | 31 |
| Oil | 0.0 | 2.4 | 39 | 46 |
| Nuclear | 0.0 | 0.0 | 0 | 1 |



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# activities

Concept 5
Objective 5.2 (continued)

6. Invite the school custodian and a representative of the school food services to discuss school waste disposal (both liquid and solid).

   Tour the community waste disposal sites. Have the representative explain local and state regulations that deal with disposal problems.

   Divide the class into groups to dramatize ways that students can help reduce waste, using the following situations:
   - school cook discussing waste of food by children and problems of purchasing food for the menus, etc.
   - school custodian confronted by local residents complaining about smoke produced in burning solid waste.
   - a cockroach loose at night in the school cafeteria.
   - the custodian confronting the PE instructor over excessive hot water usage. Vice versa with parent and student complaints about lack of hot water.

   Present the dramatizations at a meeting of the school board, PTA, and local service clubs.

   SUGGESTED GRADE LEVEL: 4-6

7. Find out what regulations exist in your state concerning the use of snowmobiles, trail bikes and/or sand dune vehicles. Discuss in class whether or not the use of these vehicles can be justified on the basis of their energy use and environmental impact. Write an essay exploring and supporting a position for or against using one of these vehicles.

   SUGGESTED GRADE LEVEL: 4-12

8. Design a tax depletion allowance for industries and power producers which utilize geothermal steam power (or nuclear power, solar power, etc.)

   SUGGESTED GRADE LEVEL: 10-12

9. Consider and understand various kinds of taxes and how they can encourage or discourage energy conservation.

   SUGGESTED GRADE LEVEL: 10-12





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**concept:** 5 - Social and political institutions influence the practice of energy conservation.

**conservation**

**objective:** 5.3 - The student will value human organizations which influence energy conservation.

## activities

1. Form a study group, a club, or act as class representatives in order to make recommendations to the school board, to planning groups, to a parent group, etc., that will improve energy conservation practices in your school or school district.

   SUGGESTED GRADE LEVEL: 4-12

2. Survey energy uses in your school under various climatic and seasonal conditions. Record the results of your year-long study and make recommendations to your local authorities.

   SUGGESTED GRADE LEVEL: 4-12

3. Survey energy use in any local organization, i.e., a church, the city, a local mall, recreation facility, etc. Record the results of the study and make a report to the organization.

   SUGGESTED GRADE LEVEL: 10-12

4. Begin an Energy Resource Center (ERC) for the school. Locate it in the library or a classroom. This project would require at least one semester--perhaps an entire school year. Some tasks would include:
   - Develop a vertical file system which contains timely information on such topics as energy production, energy consumption, environmental problems, energy economics problems, alternate energy sources, and energy conservation measures.
   - Compile a bibliography of available school and community print and non-print materials on energy.
   - Provide copies of a current listing of institutions and agencies which can provide information on energy.
   - Write to local, state, and federal agencies explaining the ERC and requesting assistance and material.
   - Compile a list of community leaders who can speak on energy topics.
   - Make energy information available to students, teachers, parents, and community members.
   - Prepare a work schedule for students who will assist in the center--perhaps with the school librarian as supervisor.

   SUGGESTED GRADE LEVEL: 10-12

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# activities

Concept 5
Objective 5.3 (continued)

5. Organize a day-long conference to explore the ways by which your city, county, state or nation can change from a high energy using society to a more durable, less energy intensive society. Publish the proceedings of the conference as a journalism class project as a corollary activity. Distribute to other student interest groups in the immediate region.

SUGGESTED GRADE LEVEL: 10-12

6. Organize and conduct an "Energy Fair" one weekend. Through a steering committee composed of students from a class, club, or student council, solicit assistance from students and teachers in the various subject areas (social studies, science, home economics, driver's education, etc.) at your school.

Illustrate a history of individuals and events involved in energy development; a history of energy consumption patterns; a pictorial display of factors that led to our present energy problems; and a list of governmental agencies and institutions with responsibilities for developing energy resources. A list of energy education/conservation materials would be of value to students, teachers, and citizens. Determine what agencies and institutions already have materials that could be distributed at the Fair.

Prepare "fact sheets" on energy production and possible economic and ecological trade-offs; exhibit some basic energy concepts such as photosynthesis; prepare displays on solar cells, windmills, electric motors, and insulation materials. An exhibition of careers related to energy development would also be of value to students and parents.

This activity will be more successful if some source of funding assistance can be located through civic groups, local merchants, or the Chamber of Commerce. The Chamber of Commerce can assist with finding locations for holding the "Energy Fair" (perhaps a large shopping mall which regularly has exhibits).

Contact organizations:
- State energy office
- Chamber of Commerce
- Local utility company

SUGGESTED GRADE LEVEL: 7-9





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# activities

Concept 5
Objective 5.3 (continued)

7. Plan, organize, and conduct a community-wide educational campaign for energy conservation. Specifically include the following:
   - Provide homeowners with carefully reasoned energy conservation tips (cooking, heating, cooling, insulation, thermostat control, night setback, reduced lighting, carpooling, vanpooling).
   - Collect and/or prepare energy conservation materials for citizens or community business and government leaders in the residential, commercial, industrial, transportation, agricultural and governmental sectors.
   - Organize a program to train students how to conduct home energy audits.
   - Organize a speakers' bureau of both experts and laymen who will voluntarily make energy conservation presentations.
   - Inform citizens about the disadvantages and advantages of developing energy resources.
   - Organize an energy conservation awards program for students and homeowners.

   SUGGESTED GRADE LEVEL: 4-9

8. Using the Directory of Associations, list the names and addresses of all organizations involved with coal production, transportation, and use.
   - Write a letter to these organizations requesting information regarding their efforts to conserve energy.
   - Create oral reports and visual displays when these materials arrive.

   SUGGESTED GRADE LEVEL: 7-12

9. Write for information concerning energy from the following organizations:

| | |
|---|---|
| Sierra Club | American Manufacturing Association |
| Wilderness Society | American Petroleum Institute |
| OPEC | Consolidated Edison |
| U.S. Chamber of Commerce | Electric Power Research Institute |
| Audubon Society | Zero Population Growth |
| Friends of the Earth | Wide Earth Society |
| Common Cause | |

   Compare the positions taken by two or more of these groups concerning a given controversy, i.e. Alaskan pipeline or breeder reactors.

   SUGGESTED GRADE LEVEL: 9-12



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# activities

Concept 5
Objective 5.3 (continued)

10. Collect and display advertisements illustrating methods that industry has used to implement energy conservation policies.

SUGGESTED GRADE LEVEL: 4-12

11. Enumerate the public agencies and private organizations active in their locality which are concerned with conservation issues relating to energy.

SUGGESTED GRADE LEVEL: 6-12





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**concept:** 5 - Social and political institutions influence the practice of energy conservation.

**conservation**

**objective:** 5.4 - The student will understand that modern human societies historically have not often practiced energy conservation.

## activities

1. Develop a list of historical situations in which the environment was damaged by human failure to engage in conservation practices, for example:
   - decrease in marine mammals
   - rupture of Torrey Canyon or the Arrow
   - decline of Atlantic salmon runs
   - destruction of wetlands and tidal estuaries
   - slash and burn farming
   - Snake River salmon runs
   - buffalo herd decline in the U.S.
   - There are others.

   SUGGESTED GRADE LEVEL: 4-12

2. Select an historical event from the list developed in Activity #1. Do independent library research on the chosen event. With research data in hand, develop scenarios to present to the class which depict the following:
   - conditions which existed in the chosen area prior to the event studied
   - the reason that event occurred
   - the effect of this event on the ecological conditions described in Activity #1
   - the implications of this event today

   SUGGESTED GRADE LEVEL: 7-12

3. Analyze a variety of ways to present the scenario in Activity #2 to a target group. Some ways that could be chosen include films, dioramas, bulletin boards, slide presentations, reports or drama. Schedule a 30-minute presentation with the teacher once the scenario plans are well formed. Present the scenario to the chosen target group. After the presentation, conduct a discussion with the group to consider alternatives which could have lessened the destructive impact on the ecosystems involved.

   SUGGESTED GRADE LEVEL: 7-12

4. Debate the clearcut silviculture practices currently used by foresters in the Douglas fir of the Pacific Northwest.

   SUGGESTED GRADE LEVEL: 6-12

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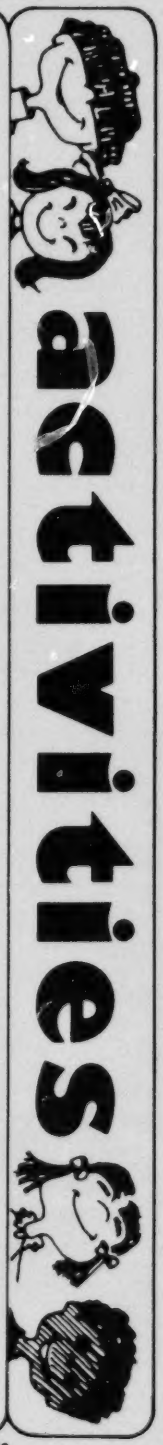
**concept:** 5 - Social and political institutions influence the practice of energy conservation.

**conservation**

**objective:** 5.5 - The student will understand that social and political acts have interrelated environmental and economic consequences.




1. Research the fundamental causes which provoked the celebrated oil crisis of 1973. On the basis of your collective research, predict the likelihood of a future occurrence.

   SUGGESTED GRADE LEVEL: 10-12

2. Organize a "Lincoln-Douglas" debate on the question, "Are there any energy producing facilities or practices which are unacceptable* to the community?" Organize a tour for the debate team in your immediate area.

   *Have one study group survey your community to establish empirical evidence of unacceptable facilities or practices.

   SUGGESTED GRADE LEVEL: 7-12

3. Prepare a comprehensive listing of energy development problems in order to understand definitions of the terms "economic cost," "social cost," and "environmental cost" as they relate to the development of energy resources. Divide into teams and prepare written material on energy development problems such as:
   - surface mining of coal
   - transporting western U.S. coal to the eastern U.S.
   - deep mining coal in the eastern U.S.
   - gas and oil exploration offshore
   - transporting or storing radioactive fuels or wastes
   - siting a nuclear power plant
   - strip mine reclamation
   - uranium mining
   - siting of transmission lines
   - thermal discharges
   - the Alaska pipeline
   - water rights vs. mining rights in the arid West (i.e. Rocky Mountain states)
   - oil shale mining and waste disposal
   - geothermal development

   SUGGESTED GRADE LEVEL: 10-12





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# activities

Concept 5
Objective 5.5 (continued)

4. Conduct a mock hearing as one would in a legislative hearing, using members of the class to represent the contending factions in the local community regarding the problems listed in Activity #3.

SUGGESTED GRADE LEVEL: 10-12

5. Create a comic strip with animal characters, using the conflict between people's energy quest and the exploitation and needs of non-human life forms.

SUGGESTED GRADE LEVEL: 10-12

6. Using hand puppets, perform a play written by the class which expresses the difficulties aquatic life experiences as a consequence of thermal dishcarge. Construct the puppets out of recycled material.

SUGGESTED GRADE LEVEL: 4-9

7. Listen to recordings of ballads. If possible, view the film "Bound For Glory," about Woody Guthrie. Write a series of ballads about energy problems and their economic and environmental costs. Perform the ballads.

SUGGESTED GRADE LEVEL: 7-12

8. Create an anthology of appropriate poems to illustrate the diversity and complexity of energy problems as they create economic and environmental consequences. Publish and distribute broadsides of locally produced poems.

SUGGESTED GRADE LEVEL: 7-12

9. Conduct an art poster contest through grade 9 to increase public awareness of the diversity of energy problems and solutions.

SUGGESTED GRADE LEVEL: 1-9



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11

# activities

Concept 5
Objective 5.5 (continued)

10. With instant printing camera, create a photo essay of some local and significant energy problem involving environmental and economic consequences.

SUGGESTED GRADE LEVEL: 4-12

11. Survey the local neighborhood to determine the number of people who have boycotted the purchase of consumer goods in the past. List the reasons given. List the products boycotted.

SUGGESTED GRADE LEVEL: 9-12

12. Write to your congressman to determine his stand on significant energy conservation legislation and report to the class. How does h/er opinion affect others?

SUGGESTED GRADE LEVEL: 4-12

13. Determine how the federal fuel allocation system has affected industries in your state. Report on the transportation, power, timber and tourist industries.

SUGGESTED GRADE LEVEL: 10-12





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**concept:** 5 - Social and political institutions influence the practice of energy conservation.

**conservation**

**objective:** 5.6 - The student will understand that the use or non-use of any energy source requires environmental trade-offs.

## activities

1. Organize a "Lincoln-Douglas" debate discussing the economic, social and environmental costs of:
   - coal usage
   - strip mining
   - reclamation
   - air pollution

   SUGGESTED GRADE LEVEL: 4-12

2. Secure films that depict contending attitudes toward reclamation of strip-mined lands. Analyze both for propaganda techniques.

   SUGGESTED GRADE LEVEL: 7-12

3. Conduct a half-day conference for your class, featuring speakers who are opponents and proponents of strip mining.

   SUGGESTED GRADE LEVEL: 10-12

4. Visit an industrial complex that uses coal and examine pollution control mechanisms.

   SUGGESTED GRADE LEVEL: 4-12



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**concept:** 5 - Social and political institutions influence the practice of energy conservation.

**conservation**

**objective:** 5.7 - The student will understand that energy decisions made by one political entity have the potential of affecting other groups.

# activities



1. Given electrical shortages in your town, list in order of priority the users whose power would be stopped. Discuss as a group why different priority lists were made. Construct a master list upon which consensus can be reached.

   SUGGESTED GRADE LEVEL: 7-12

2. Review several back issues of the Congressional Record to identify energy decisions that presently are being debated by Congress which affect other nations. Share with the class.

   SUGGESTED GRADE LEVEL: 10-12

3. Explain the factors behind the controversy over the siting of pipelines from the Arctic to the U.S.--through Canada or Alaska. Why is there a controversy?

   SUGGESTED GRADE LEVEL: 10-12

4. List the effects of Canadian decisions in setting the price of natural gas on the Pacific Northwest.

   SUGGESTED GRADE LEVEL: 10-12

5. To conserve gasoline, a decision has been made to reduce the number of automobiles in this country. Draft a set of priorities and regulations to accomplish this as fairly as possible for all citizens.

   SUGGESTED GRADE LEVEL: 7-12

6. Should limitations be placed on uses of energy, land and natural resources? What should those limitations be? What type of agency should have that regulatory power? Draft a proposal which deals with ways to cope with these problems. Secure class agreement about it.

   SUGGESTED GRADE LEVEL: 9-12

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# activities

Concept 5
Objective 5.7 (continued)

7. Describe the political or private group which you think should control energy production.

SUGGESTED GRADE LEVEL: 9-12

8. Role play various pressure groups (lobbyists) attempting to influence a state legislature to regulate or not regulate an energy source (e.g., a new coal mine or power plant). Include business, labor, environmental and local interest groups.

SUGGESTED GRADE LEVEL: 9-12

9. After a visit to your local county government or city council meeting, graphically explain the process by which a concerned citizen gets his energy concerns discussed by local decision makers. Who must one see to get things considered?

SUGGESTED GRADE LEVEL: 9-12

10. Hold a class debate on these questions: Should an automobile driver drive less because of the diminishing supply of gasoline? What should he do? What can he do? If he has the money, should the car owner be able to buy as much gasoline as he wishes?

SUGGESTED GRADE LEVEL: 9-12

11. Collect and display political cartoons that illustrate responses of government to energy conservation measures.

SUGGESTED GRADE LEVEL: 9-12

12. See the Congressional Information Service in the reference section of a major library and extract testimony regarding some energy legislation. Then assign roles and simulate the process of decision making.

SUGGESTED GRADE LEVEL: 10-12



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# activities

Concept 5
Objective 5.7 (continued)

13. Invite the mayor or city councilman of your town to your classroom to discuss any city regulations concerning energy use. Write your state legislator asking him the same questions. Include a request for the names and addresses of any state regulatory agencies. How do the regulations affect others?

SUGGESTED GRADE LEVEL: 4-12

14. Determine how the federal fuel allocation system has affected industries in your state. Report on the transportation, power, timber and tourist industries.

SUGGESTED GRADE LEVEL: 10-12

15. Assume all energy resources were cut in half. List the ways in which your local government would be affected.

SUGGESTED GRADE LEVEL: 10-12

16. Discuss ramifications of the Middle East countires refusing to sell oil resources to the United States. List five ways in which this would affect one's personal life.

SUGGESTED GRADE LEVEL: 10-12

17. Given the circumstance of gas being permanently rationed to 5 gallons per week, the class as a whole will discuss the personal freedoms they have now that would be modified as a result. They might also discuss all other aspects of gas rationing that would cause them inconvenience or change their consumer patterns.

SUGGESTED GRADE LEVEL: 4-12





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# activities

Concept 5
Objective 5.7 (continued)

18. Given the prospect of a permanent gasoline shortage, students will select from several alternatives (suggested by them and listed on the chalkboard by the teacher) one they would prefer and be prepared to defend that choice.

    The alternatives might include:

    - rationing one automobile
    - limited allocations to station or state
    - no government interference
    - raising gas prices - taxing gas
    - banning big cars, trucks, campers, travel homes, etc.
    - taxing automobiles by weight and horsepower

SUGGESTED GRADE LEVEL: 4-12





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**concept:** 5 - Social and political institutions influence the practice of energy conservation.

**conservation**

**objective:** 5.8 - The student will understand that different governments must exercise different conservation policies because resources are unevenly distributed around the world.

## activities

1. Using a large outline map of the political subdivisions of the world, locate and outline the extent of coal reserves.
   - Differentiate between the types of coal reserves such as lignite bituminous, anthracite.
   - Using arrows of varying widths to represent quantities, indicate export-import relationships. Do the same for the following:
     - oil
     - oil shale
     - geothermal
     - uranium
     - insolation (sun power)
     - natural gas
     - wood
     - tidal

   SUGGESTED GRADE LEVEL: 4-9

2. Make a bulletin board or a large map showing the distribution of the world's resources. Bring in pictures of resources or draw them and distribute them on the map.

   Discuss how this uneven distribution of resources affects the conservation policies of different governments.

   SUGGESTED GRADE LEVEL: 4-12

3. Construct a world map showing the countries that have ample supplies of energy resources. Divide the class into groups to research the conservation practices of these countries and compare the practices with those employed by countries that have limited energy resources.

   SUGGESTED GRADE LEVEL: 4-12

Concept 5



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**concept:** 5 - Social and political institutions influence the practice of energy conservation.

**conservation**

**objective:** 5.9 - The student will know and understand that conservation is practiced by human societies when alternatives are more distasteful or threatening.

## activities

1. Using the Reader's Guide to Periodical Literature, write an essay for a competitive contest discussing this question: "Why has the federal government experienced difficulty in formulating an energy policy since 1973?"

   SUGGESTED GRADE LEVEL: 10-12

2. Given the following six alternative energy strategies for the U.S.:
   1)conduct business as usual
   2)achieve U.S. energy independence by 1985
   3)develop "successor sources" to replace oil and gas over the next several years
   4)develop a nonfossil fuel energy economy
   5)increase efficiency of energy generation and use
   6)change from a "disposable" to a "durable" society

   create a chart comparing the advantages and disadvantages of each strategy. A class may be divided into six groups with each group acting as a militant support of their particular strategy. For the purpose of value clarification, critique the performance behaviors of the various groups to determine:
   - factual accuracy
   - effectiveness of presentation
   - use of propaganda devices and communication
   - value orientation and motivational posture

   Subsequently, form a mock legislative body and create an appropriate energy strategy for the United States.

   SUGGESTED GRADE LEVEL: 7-12

3. Debate the question that conservation is practiced by human society when consequences are distasteful or threatening. Include the following:
   - rise in the price of cars
   - gas price increases since 1973
   - increase in the purchase of small cars since 1974-75

   SUGGESTED GRADE LEVEL: 10-12

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**concept:** 5- Social and political institutions influence the practice of energy conservation.

**conservation**

**objective:** 5.10 - The student will know and understand that individuals emphasize their own needs and wants before they emphasize conservation practices.

**activities**

Concept 5

1. Using Lawrence Kohlberg's Theory of Moral Development (Harvard University--also available in the Adapter's Guide for Value Education, Oregon State Department of Education, or from Ashland Public Schools, Ashland, OR 97520), and given the following list of energy users and producers, project which stage of moral development each user or producer emphasizes and what disagreements and accomodations might develop:

   - a homemaker
   - a public utility lobbyist or education officer
   - an aluminum processing plant stockholder
   - a Greenpeace supporter
   - a militant environmental group member
   - a Chamber of Commerce official
   - a state legislator
   - a county commissioner
   - a local building contractor
   - an architect
   - a logger

   The Adapter's Guide for Value Education is an extensive source for hundreds of activities linked to this objective. These activities are all geared for elementary school students grades 4, 5, and 6.

   SUGGESTED GRADE LEVEL: 10-12

2. Members of the class will select a tentative career goal appropriate to their skills and interests. Utilizing the following energy opinionaire, they will defend the values represented by their chosen occupation, regarding energy use and conservation.

   Roles could include:

   - engineer
   - banker
   - stockholder
   - mayor
   - corporation lawyer
   - consumer advocate
   - Sierra club member
   - laborer
   - parks director
   - wildlife specialist
   - homemaker
   - contractor
   - architect
   - nature conservatory member, etc.

   SUGGESTED GRADE LEVEL: 10-12



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# activities

Concept 5
Objective 5.10 (continued)

ENERGY OPINIONAIRE

NAME_____ DATE_____

Class_____ TEACHER_____

Directions: Please cross out the word or phrase within the parentheses which least indicates your opinion. Be prepared to defend your opinion or belief.

Example: I believe that all children (should, ~~should not~~) go to school.

I believe that:

1. The energy resources in the United States (are, are not) controlled by monopolies.
2. There (is, is not) a shortage of oil in our country.
3. We (should, should not) generate more energy from nuclear and fossil fuels.
4. Solar energy technology for generating electricity (is, is not) well established at this time.
5. Government funds (should, should not) be used to develop the railroads and barge traffic.
6. If fuel prices were to decline, consumption (would, would not) greatly increase.
7. American lifestyles (are, are not) wasteful of energy.
8. Manufacturers (should, should not) be forced to reveal the energy cost of their products.
9. Nonreturnable and disposable containers (should, should not) be discontinued.
10. Rising energy costs (have, do not have) a direct, personal impact on everyone.
11. Everyone (should, should not) observe reduced speed limits to conserve energy.
12. The use of energy (is, is not) a moral problem involving stewardship of resources.
13. The government (should, should not) restrict the size of cars.
14. The cost of pollution control (should, should not) be included in the individual customer's bill.
15. An individual (can, cannot) have an impact on energy consumption.
16. Individuals (will, will not) conserve energy if they realize there is a problem.



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# activities

Concept 5
Objective 5.10 (continued)

17. We (should, should not) develop energy resources regardless of environmental costs.

18. All demands for energy (will, will not) be met in the year 2000.

19. People (are, are not) born greedy and selfish in respect to the use of natural resources.

20. Strict federal laws (will, will not) be the major factor in energy consumption.

21. Nuclear power (is, is not) too dangerous to be used in producing electricity.

22. Our government (is, is not) being effective in solving our energy problems.

23. Everyone (should, should not) be required to pay for energy regardless of economic level.

24. The production of an adequate supply of energy (is, is not) a major problem in our country today.

25. The energy problem (is, is not) political rather than technological.

26. The average citizen (is, is not) getting honest information on energy problems and their solutions.

27. Energy production (should, should not) be controlled by government rather than private industry.

28. Alternative energy sources such as wind, geothermal, solar, and tidal power (are, are not) receiving adequate funds for their development.

29. Foreign countries (do, do not) have the right to charge any price they please for their natural resources.

30. My family (is, is not) doing an adequate job of conserving energy.





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# activities

Concept 5
Objective 5.10 (continued)

3. Construct your own energy opinionaire and identify the differences and biases which exist in both.

SUGGESTED GRADE LEVEL: 10-12

4. Collect cartoons depicting various value conflicts involving energy use and conservation. Create a display of the collection.

SUGGESTED GRADE LEVEL: 7-12

5. Create a series of posters which depict value conflicts involving energy use and conservation. Place the posters in appropriate places.

SUGGESTED GRADE LEVEL: 7-12

6. Write a series of editorials for the school paper advocating your particular value position toward significant energy problems.

SUGGESTED GRADE LEVEL: 7-12

7. Develop a list of ways that producers, through advertising, attempt to convince consumers that nonessentials are indispensable. The list should be supported by newspaper and magazine clippings. If it is possible to arrange, a brief, taped segment of a particularly "compelling" radio or TV commercial would be an informative highlight of this class project.

   Give examples of how you have been swayed by the power of advertising.

   Did you realize that you very often advertise products for a retailer or manufacturer? Some examples of this are: labels in clothing, shopping bags that you carry away from the store, or a dealer's name permanently affixed to the automobile you buy. Can you think of other examples?

   Should manufacturers and retailers get this type of free advertising? Can you do anything about it if you object?

   Make a list of some of our scarce resources which are further diminished by successful advertising campaigns for more modern products, greater "convenience" in packaging, and other "technological innovations."

   Suggest ways in which the power of the advertising industry might act more constructively in terms of our resource and energy problems. Is it likely that they will change their approach? Explain.

SUGGESTED GRADE LEVEL: 7-12



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# activities

Concept 5
Objective 5.10 (continued)

8. Consumption is continually being increased and a large part of the increase is a result of the producer's ability to create wants. This expansion of production in turn increases the rate of resource use. In connection with this stimulation of artificial "need," categorize products by the following types of advertising appeals:
   - emotional
   - logical
   - creative (humorous, artistic)
   - testimonial
   - psychological

   Identify explicitly each commercial or advertisement to which you refer.

   Show how business has created needs in areas where no need existed 25 years ago...50 years ago...75 years ago.

   Use economic statistics to show actual growth in the areas selected for the question above.

   Did the areas of growth you chose as examples represent the use of renewable or nonrenewable resources? Explain.*

   SUGGESTED GRADE LEVEL: 7-12

   *Note: Both Activity # 7 and # 8 are adapted from the New York State Department of Education guide titled Living Within Our Means: Energy and Scarcity.

9. Invite various community representatives to the class to discuss the question, "Is is moral to inflame human desire to consume when no real human need exists?"

   SUGGESTED GRADE LEVEL: 7-12

Concept 5



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**concept:** 6 - Energy related decisions affect lifestyles, quality of life and standards of living.

**conservation**

**objective:** 6.1 - The student will understand that some persons and societies measure quality of life and standards of living by per capita energy consumption.

## activities

1. Compare the standard of living of the U.S. in Revolutionary War, Civil War, World War I, World War II times and the present. Relate the approximate per capita consumption of energy for an individual to each time period and be able to explain the reason for the differences. This could be done by mural or by a time-line continuum.

   SUGGESTED GRADE LEVEL: 10-12

2. Compare the standard of living and per capita energy consumption of the North American Indian to the students' personal energy consumption.

   SUGGESTED GRADE LEVEL: 4-6

3. Compare the type and amount of energy required to produce a car in the U.S. to: England, France, W. Germany, Sweden and Japan (any with all).

   SUGGESTED GRADE LEVEL: 7-9

4. Find out from your local electric/gas utility how the actual cost of service to each class of customers---residential, commercial, industrial---is computed. Why is the actual cost of service to each category different?

   SUGGESTED GRADE LEVEL: 10-12

5. Using the lifestyle survey form on the next page, compare the responses of your grandparents, parents, and fellow students.
   - Graph the differences item by item.
   - Discuss differences with respondents.
   - Report reasoning back to the class.

   SUGGESTED GRADE LEVEL: 10-12

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# activities

## LIFESTYLE SURVEY FORM

Name: _____

Date: _____

Place an X in the column which best describes your feeling about giving up a particular item.

| ELECTRICAL APPLIANCE OR ITEM* | Do Not Have | Very Easily | With Some Difficulty | With Great Difficulty | Impossible |
|---|---|---|---|---|---|
| Radio | | | | | |
| Stereo | | | | | |
| Air conditioning (at home) | | | | | |
| Air conditioning (at work) | | | | | |
| Electric fan | | | | | |
| Clock | | | | | |
| Freezer | | | | | |
| Typewriter | | | | | |
| Copy machine | | | | | |
| Water heater | | | | | |
| Power tools | | | | | |
| Refrigerator | | | | | |
| Iron | | | | | |
| Dishwasher | | | | | |
| Mixer | | | | | |
| Doorbell | | | | | |
| Electric stove | | | | | |
| Hair dryer | | | | | |
| Elevator | | | | | |
| Toaster | | | | | |
| Electric blanket | | | | | |
| Garbage disposal | | | | | |
| Blender | | | | | |
| Lights | | | | | |
| Clothes washer | | | | | |
| Electric guitar | | | | | |
| Telephone | | | | | |
| Sewing machine | | | | | |
| Trashmasher | | | | | |
| Electric curlers | | | | | |
| Color TV | | | | | |
| B&W TV | | | | | |
| Electric toothbrush | | | | | |
| Clothes dryer | | | | | |

*Add other items you may have in your home.

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# activities

6. By interviewing other people, find out what the "good life" is as seen by students and what it is as seen by adults.

SUGGESTED GRADE LEVEL: 4-6

7. Construct a model society that constitutes the "good life," which can be used as background for making judgments concerning energy-resources use, considering both yourself and others. (This can be done by having a stranger visit an inhabited island.)

SUGGESTED GRADE LEVEL: 4-6

8. List in order your uses of electricity, from necessary to unnecessary. Describe your living conditions without various uses of energy. Develop a scale from a level where you are unable to survive to a level of ultimate luxury. Compare yours to other lifestyles.

SUGGESTED GRADE LEVEL: 2-6

9. Discuss whether happiness is equated with energy--considering luxuries. What would you be willing to give up right now? Contrast the enjoyment of a bicycle to compulsory exercise classes. Compare your attitudes with others.

SUGGESTED GRADE LEVEL: 2-6

10. List those characteristics that distinguish a high standard of living from a low standard of living, or write an essay which describes and defines differences between high and low standards of living.

SUGGESTED GRADE LEVEL: 6-12

11. List the electrical appliances in your home in the order of their importance. List separately the ones you feel could be eliminated without lowering the "quality of existence."

SUGGESTED GRADE LEVEL: 3-12

12. List ten things for which people now use labor-saving devices that they once did for themselves. Speculate on how the need to own an electric toothbrush was created.

SUGGESTED GRADE LEVEL: 3-12





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# activities

Concept 6
Objective 6.1 (continued)

13. Write an essay on why it is important or unimportant that your family "keep up with the Joneses," and show how energy contributes to this pressure.

SUGGESTED GRADE LEVEL: 7-12

14. Make a collage of pictures showing your lifestyle.

SUGGESTED GRADE LEVEL: 4-8

15. Speculate on changing lifestyles in Iran, Venezuela, or any of the Arabian countries as an outcome of increased oil demands/prices. Check your speculations with current reports in periodicals.

SUGGESTED GRADE LEVEL: 10-12



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**concept:** 6 - Energy related decisions affect lifestyles, quality of life and standards of living.

**conservation**

**objective:** 6.2 - The student will understand that the practice of energy conservation may modify lifestyles.

## activities

1. Compare several families to determine elements of lifestyle.

   SUGGESTED GRADE LEVEL: K-12

2. List the lifestyle elements of your own families and attempt to predict changes resulting from energy conservation practices.

   SUGGESTED GRADE LEVEL: K-12

3. Compare families from different cultures to determine how energy patterns determine lifestyles.

   SUGGESTED GRADE LEVEL: K-12

4. Given a specific conservation action (i.e. gas rationing) attempt to determine if or how your family's lifestyle would be affected.

   SUGGESTED GRADE LEVEL: 4-12

5. Identify ways in which you may personally practice energy conservation and determine how this will affect your individual lifestyle.

   SUGGESTED GRADE LEVEL: K-12

6. List five different electric appliances used in your home that the family could most easily live without. State reasons for each of the decisions and describe what effect this would have on your family.

   SUGGESTED GRADE LEVEL: K-12

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**concept:** 6 - Energy related decisions affect lifestyles, quality of life and standards of living.

**conservation**

**objective:** 6.3 - The student will understand that different lifestyles require different amounts of energy.

## activities

1. Research to determine if American Indian societies practiced energy conservation.

   SUGGESTED GRADE LEVEL: 4-6

2. Visit communities with distinctive lifestyles to observe the types and amount of energy being utilized. Determine if a conservation practice would be acceptable and/or practical for that community.

   SUGGESTED GRADE LEVEL: 4-6

3. Visit a farm (ranch) to determine what products are reused and, as a result, what resources are being conserved.

   SUGGESTED GRADE LEVEL: K-6

4. Compare the cost and amount of energy required for sewage handling methods in the U.S. to that in an underdeveloped country. Determine if each method is the best option for each country or if there might be better alternatives, taking into consideration the impact on the quality of life.

   SUGGESTED GRADE LEVEL: 4-9

5. Discuss the social implications of energy use imbalance in the world today.

   SUGGESTED GRADE LEVEL: 7-12

6. Discuss the political implications of energy use imbalance in the world today.

   SUGGESTED GRADE LEVEL: 7-12

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# activities

Concept 6
Objective 6.3 (continued)

7. List all the "energy users" that you personally own or use, such as radios, toys, appliances, etc. In the list, state the type of energy required, such as AC power battery, wind-up spring, etc. After completing the list, compare it with the items you might own in a nation which uses less energy, such as India. Try to list the "energy users" the Indian child might use. Would you be willing to do without some of these items to save energy?

   SUGGESTED GRADE LEVEL: 4-6

8. Compare the lifestyle of an underdeveloped society with your lifestyle. Consider the energy consumed, and discuss the difference. Do the underdeveloped societies save more energy?

   SUGGESTED GRADE LEVEL: 2-6

9. List the ethical implications when one social group uses 25 times as much of an unrenewable resource as another social group. Discuss fairness as related to the "Haves" and "Have-Nots."

   SUGGESTED GRADE LEVEL: 4-12

10. List those characteristics that distinguish a high standard of living from a low standard of living, or write an essay which describes and defines the differences between high and low standards of living.

    SUGGESTED GRADE LEVEL: 6-12

11. Develop a common definition for "standard of living" in your classroom. Discuss differences in the way of life for different standards. Consider the life of a migrant child, a farm child, an apartment dweller in the city, and a child living in a small American city. Relate lifestyle differences to energy availability/family.

    SUGGESTED GRADE LEVEL: 7-12





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# activities

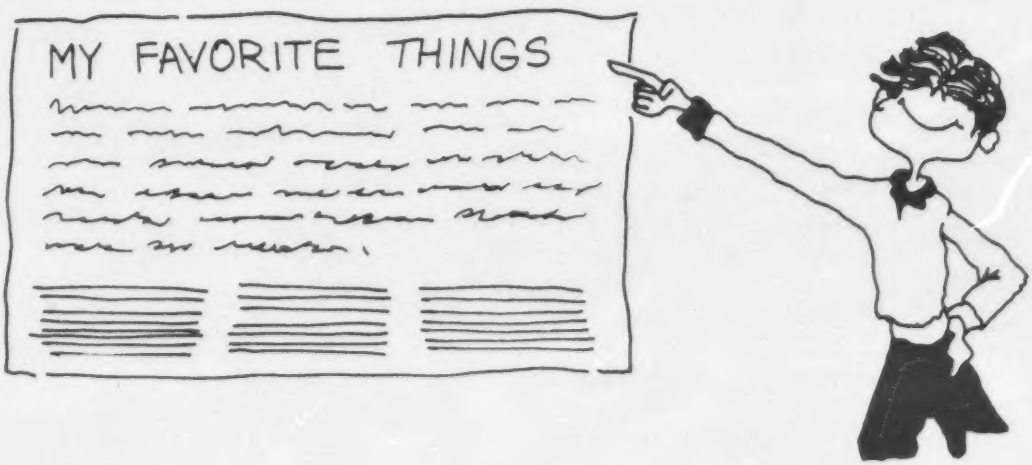
Concept 6
Objective 6.3 (continued)

12. Divide the class into groups of four. Each group will list the characteristics of a lifestyle that they would find most satisfying. One representative from each group will then act as a group using their combined lists to arrive at a list characterizing the "good life." The class will again work in groups to design a lifestyle, using the characteristics of the "good life" which use as little energy as possible. Evaluate each group's lifestyle and determine which will use the most energy. Which lifestyle uses the least?

SUGGESTED GRADE LEVEL: 4-12

13. List the devices you use which consume energy. (The list may be written or drawn.) Compare and discuss in a group the differences detected among the various members. If you did not have enough energy to operate all of them, which ones would you stop using first? Do you all agree?

SUGGESTED GRADE LEVEL: K-3



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**concept:** 6 - Energy related decisions affect lifestyles, quality of life and standards of living.

**conservation**

**objective:** 6.4 - The students will understand that present energy conservation practices affect the quality of life and standard of living of future societies.

**activities**



1. Describe changes in the U.S. that occurred when coal was substituted for wood as a general energy source. What new inventions necessitated this substitution?

   SUGGESTED GRADE LEVEL: 7-12

2. Describe the changes in the U.S. that occurred when oil and petroleum products were substituted for coal as a general energy source. What new inventions necessitated the substitution?

   SUGGESTED GRADE LEVEL: 7-12

3. Explain why it is now probable that coal will be substituted for petroleum products as a general energy source. Explain how this substitution may affect the quality of life and standard of living in the U.S.

   SUGGESTED GRADE LEVEL: 7-12

4. Describe the energy resources which are being depleted most rapidly. (Explain why.)

   SUGGESTED GRADE LEVEL: 4-9

5. Describe inventions since 1800 in the U.S. which have conserved the most energy.

   SUGGESTED GRADE LEVEL: 4-9

6. Describe inventions since 1800 in the U.S. which have utilized or exploited energy the most.

   SUGGESTED GRADE LEVEL: 4-9

7. Compare the energy practices when the U.S. was a rural society to our present day urban society.

   SUGGESTED GRADE LEVEL: 4-9



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# activities

Concept 6
Objective 6.4 (continued)

8. List and explain why certain resources are considered to be most critical to save for future generations.

SUGGESTED GRADE LEVEL: 4-9

9. Explain how living in cities may conserve energy more than our present suburban patterns of living.

SUGGESTED GRADE LEVEL: 4-9

10. Compare the public versus private forms of mass transportation (i.e. cost and efficiency).

SUGGESTED GRADE LEVEL: 7-12

11. Describe items of your lifestyle you are willing to give up to conserve energy for children in the future.

SUGGESTED GRADE LEVEL: 7-9

12. Assume you live five miles from the school. Describe the most energy efficient motorized form of transportation you could use to get there. Apply this principle to other modes of your lifestyle.

SUGGESTED GRADE LEVEL: 4-6

13. Write a poem about "lifestyles 1980."

SUGGESTED GRADE LEVEL: 7-12

14. See Concept 7, Objective 7.2, Activity #5.

SUGGESTED GRADE LEVEL: K-6

15. Create, direct and act out short plays dealing with the effects of litter on your daily lives. (A futuristic slant can be given to this, similar to the "Star Wars" garbage compressor scene.)

SUGGESTED GRADE LEVEL: K-3



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# activities

Concept 6
Objective 6.4 (continued)

16. Read stories The Last Free Bird and Farewell to Shady Glade. Have students orally compare stories or make illustrated picture books or story books about a particular animal in its native environment telling how litter affects its life.

SUGGESTED GRADE LEVEL: K-3





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**concept:** 6 - Energy related decisions affect lifestyles, quality of life and standards of living.

**conservation**

**objective:** 6.5 - The student will understand that short-term energy gains may result in long-term energy losses.

## activities

1. Research the impact of goats on the Mediterranean countries.

   SUGGESTED GRADE LEVEL: 7-12

2. Compare cedars of Lebanon historically with present forest topography in Lebanon.

   SUGGESTED GRADE LEVEL: 7-12

3. Research the loss of long grass species due to over-grazing in the New Mexico and Arizona grasslands.

   SUGGESTED GRADE LEVEL: 9-12

4. Go to the library. Find current pictures of Israel, Lebanon, and Syria. Then read the descriptions of the areas found in the historical books of the Bible, using a Bible dictionary, Bible geography or a biblical concordance to find the appropriate reference in the Biblical text. Determine what factors were responsible for the permanent environmental changes to the area. Determine if the changes were beneficial.

   SUGGESTED GRADE LEVEL: 7-12

5. Interview your parents concerning who makes the decisions about the purchase of major electric appliances. Ask what influences their selection of brand, size, and model. Ask whether the amount of electricity required is considered in the long term.

   SUGGESTED GRADE LEVEL: 5-12

6. See Concept 7, Objective 2, Activity #6.

   SUGGESTED GRADE LEVEL: K-3

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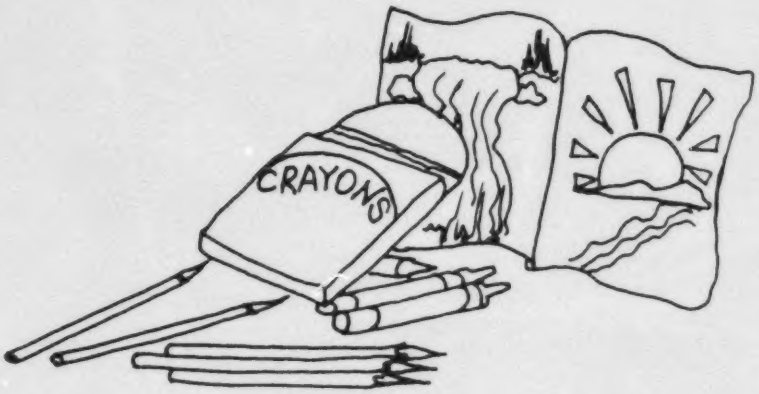
# activities

Concept 6
Objective 6.5 (continued)

7. Provide the students with three choices of coloring materials: brand new crayons, broken and used brand X crayons, and a set of light pastel pencils. Assign a number of coloring assignments using energy-related designs (sun's rays, uses, etc.). As the class experiences difficulty securing their first choices, relate their experiences to shortages that we all face: gas shortages, depletion of coal, etc. Point out that slow use of resources prolongs the availability of resources.

SUGGESTED GRADE LEVEL: K-3





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**concept:** 6 - Energy related decisions affect lifestyles, quality of life and standards of living.

**conservation**

**objective:** 6.6 - The student will understand that world population growth and energy conservation decisions will change occupational patterns and options.

## activities

1. Make a list of all energy-related jobs. As a follow-up lesson, list those jobs which would no longer exist when resources become scarce.

   SUGGESTED GRADE LEVEL: 1-9

2. Identify occupations your parents have that would be eliminated in the future when common resources become scarce.

   SUGGESTED GRADE LEVEL: 1-9

3. Visit your local automotive dealer and your transit system, and determine what jobs would be affected by a switch from individual automobiles to a mass transit system.

   SUGGESTED GRADE LEVEL: 9-12

4. Make a survey of jobs that are related to the use of private automobiles. Remember: they need repair, replacement parts, insurance, services. etc.

   SUGGESTED GRADE LEVEL: 4-12

5. Construct an occupational web with the automobile at the center. Then determine how the occupational pattern is disturbed by removing the automobile.

   SUGGESTED GRADE LEVEL: 4-12

6. Write a scenario of how life would be in the year 2000 without the automobile.

   SUGGESTED GRADE LEVEL: 5-12

7. Ascertain the number of jobs related to hydrothermal energy generation.

   SUGGESTED GRADE LEVEL: 9-12

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# activities

Concept 6
Objective 6.6 (continued)

8. Invite a police officer to share with the class h/er duties. Ask the officer if it is necessary to have patrol cars. Wouldn't more energy be saved if officers walked a "beat" instead of driving a "beat"? (The teacher should help the students realize the trade-offs between energy conservation vs. public safety.) Also ask the officer to respond to this question: If all patrol cars were eliminated, would it change patterns and options within the occupation?

SUGGESTED GRADE LEVEL: K-3





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**concept:** 7 - The earth's energy resources and systems can support only limited numbers of people without drastic alterations in present technological and social systems.

**conservation**

**objective:** 7.1 - The student will understand that population growth increases the pressure on the earth's resources.

## activities

1. Discuss what would happen if ten more children were added to the classroom and no new materials were added.

   SUGGESTED GRADE LEVEL: 4-6

2. Bring a second class of students into the classroom. Bring in no additional materials (books, papers, pencils, chairs, etc.) After one class period, discuss your reactions and feelings.

   SUGGESTED GRADE LEVEL: 1-6

3. Discuss the problems related to decisions society will face in determining the distribution of resources as they become more scarce.

   SUGGESTED GRADE LEVEL: 7-9

4. Discuss the effect of adding another member to a household without adding any additional resources.

   SUGGESTED GRADE LEVEL: 4-6

5. Discuss what might happen if 100 people visited the school for lunch without letting the cafeteria know. Would the food resources be scarce? Relate this to the possibility of energy resources being scarce because of population growth and the impact it would have on people.

   SUGGESTED GRADE LEVEL: 4-9

6. Analyze attitudinal changes that occur when resources become scarce, such as hoarding and violence.

   SUGGESTED GRADE LEVEL: 7-9

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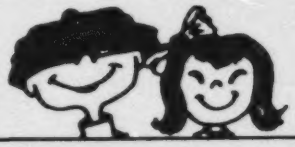

# activities

Concept 7
Objective 7.1 (continued)

7. Debate: Should society attempt to control population growth?

As the population of the United States and world increases, more stress is placed on our limited natural resources. Here in the United States, our population is growing by about 1.7 to 2.5 million people annually. Although we comprise less than six percent of the world's population, Americans use over one-third of the world's resources and energy.

Conduct research and contact organizations to learn more about the population situation in your state, the United States, foreign countries, and the world. Specifically, obtain answers to the following kinds of questions:

1) What is the approximate population of your state? Of the United States? The world? How fast is the population increasing in each of these?
2) What is population control? What are the major problems in trying to control population growth?
3) Is there any difference between birth control and population control? Explain.
4) What is the meaning of zero population growth?
5) Approximately how much money does the United States government spend each year on population research?
6) What would you believe to be the most important components of a national population policy (e.g., population size, rate of growth, distribution, etc.)?

SUGGESTED GRADE LEVEL: 10-12

8. Discuss what would be the advantages and disadvantages of a national population policy. Should government have the right to limit the number of people who can live in a given area (community)? Explain.

SUGGESTED GRADE LEVEL: 10-12



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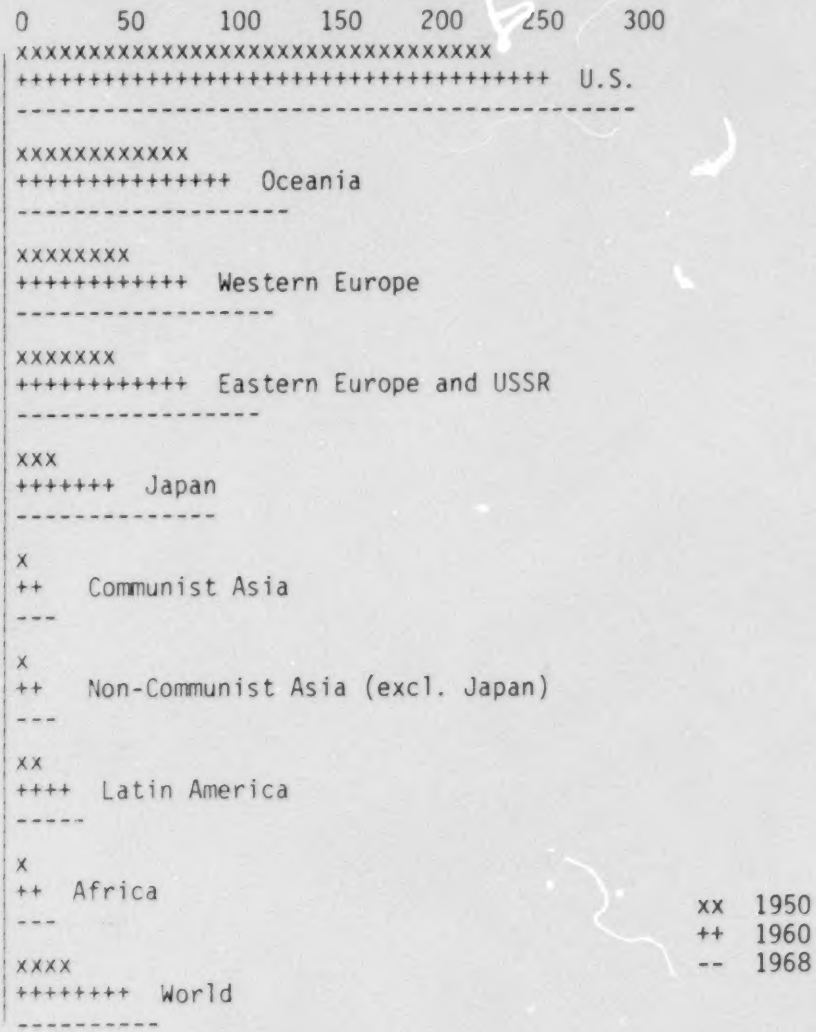
Concept 7
Objective 7.1 (continued)

9. Compare the bar graph Energy Use Per Capita, U.S. and the World, 1950-1968 with a similar population growth graph which you are to research and create. What are the moral and ethical implications you perceive? Compare and discuss your findings with the class.




SOURCE: Energy Policy Project of the Ford Foundation, Exploring Energy Choices: A Preliminary Report (Washington, D.C.: The Ford Foundation, 1974, p. 128.

SUGGESTED GRADE LEVEL: 10-12





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# activities

Concept 7
Objective 7.1 (continued)

10. Determine the maximum population that could live in the U.S. and not deplete our major natural resources.

SUGGESTED GRADE LEVEL: 10-12

11. Discuss the merits of land-use planning to ease population pressure and to utilize energy resources more efficiently.

SUGGESTED GRADE LEVEL: 10-12

12. Describe why resources around centers of population often are depleted or overused.

SUGGESTED GRADE LEVEL: 7-12

13. List examples of restraints that might result from over-population.

SUGGESTED GRADE LEVEL: 9-12

14. How could the concept of a limited earth aid ultimate population-carrying capacity and help us predict the quality of life for future generations?

SUGGESTED GRADE LEVEL: 10-12

15. Write down the rules to be used if you had to redistribute the resources of the world.

SUGGESTED GRADE LEVEL: 10-12

16. Describe the governmental unit which should be responsible for determining the rules under which energy or fuel use might be rationed.

SUGGESTED GRADE LEVEL: 10-12



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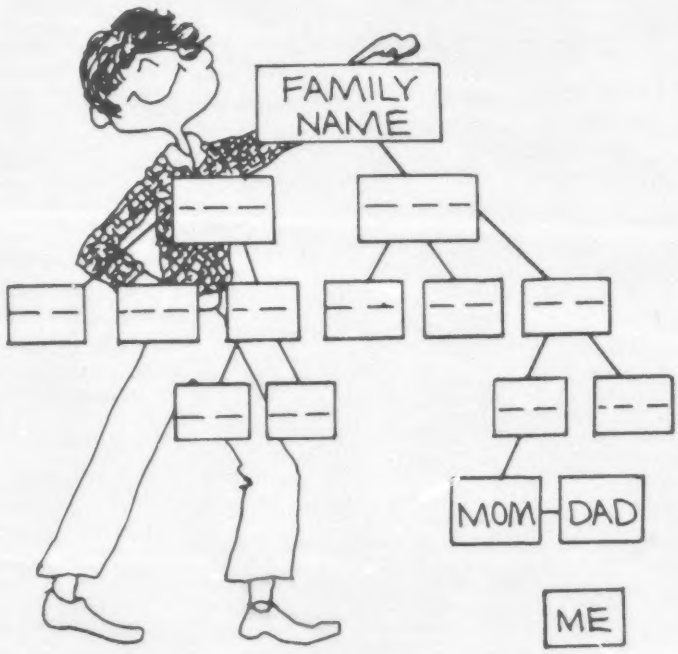
Concept 7
Objective 7.1 (continued)

17. Draw your family tree for the last three generations to show the increase in population of your family over a three generation period. Draw hypothetical five generation family trees, one with two offspring/couple and one with four offspring/couple. Compare resultant population sizes.

SUGGESTED GRADE LEVEL: 4-12





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**concept:** 7 - The earth's energy resources and systems can support only limited numbers of people without drastic alterations in present technological and social systems.

**conservation**

**objective:** 7.2 - The student will understand that per capita consumption affects the useful life of the earth's resources.

## activities

1. How do energy resource needs compare for an infant, an elementary student, a high school student, a young adult, a middle-aged person, and a senior citizen?

   SUGGESTED GRADE LEVEL: 7-12

2. Analyze the energy requirements of a young family unit of 5 members versus an established family unit of 5 members (i.e. a young family unit might purchase a home, second car, additional furniture, etc., whereas an established family has obtained these things already and primarily is maintaining what it has).

   SUGGESTED GRADE LEVEL: 7-12

3. Compare the per capita energy consumption of the U.S. to European countries.

   SUGGESTED GRADE LEVEL: 7-12

4. Discuss why society continues to expand its energy appetites.

   SUGGESTED GRADE LEVEL: 7-12

5. Obtain an Igloo water cooler--5 gallons. Weigh the container empty and then when it is full of water. (The amount of water in the container cannot be seen, so the class will not know how much of the "resource" remains.)

   Have an agreement among all class members that their cooler is the only place they will get their drinking water. Allow students to obtain a drink whenever they wish, and record the length of time it takes to use all the water. Next, refill the container and again have students use this as their only source of water. This time, weigh the water taken each time a student gets a drink (use grams). Keep a running subtraction record and see how much longer the "resource" will last.

   SUGGESTED GRADE LEVEL: K-6

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# activities

Concept 7
Objective 7.2 (continued)

6. Provide two gallon jars filled with peanuts. Divide the class into two groups--the heavy users and the light users. Let the group determine how many peanuts each member will consume each day for a period of ten days. At the end of the period, determine how many days' supply each group has remaining. Let the groups then decide their consumption to extend the life of the resource and still supply some peanuts for each member.

SUGGESTED GRADE LEVEL: K-6





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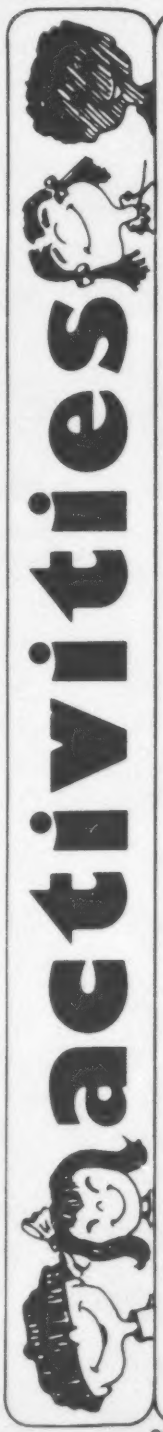
**concept:** 7 - The earth's energy resources and systems can support only limited numbers of people without drastic alterations in present technological and social systems.

**conservation**

**objective:** 7.3 - The student will understand the differences between linear and exponential forms of growth.




1. To illustrate exponential growth, secure a male and female fruit fly and place them in a test tube with about two inches of fly media. Observe and count the numbers of offspring on a weekly basis for four or five weeks. (Consult your high school biology teacher for a source of flies and directions on making up the media.)

   SUGGESTED GRADE LEVEL: 7-12

2. Secure a checkerboard and a package of rice. Have the students place rice grains on each square, doubling the number placed on each preceding square. (Prior to the activity, have students postulate how many grains they will need for squares 4, 8, 12, 16, 64.) Have the class discuss the effect on world population if the grains of rice were people and the checkerboard were the world.

   SUGGESTED GRADE LEVEL: 7-12

3. Using the nursery rhyme "As I Was Going To St. Ives," determine how exponential growth patterns create the riddle involved.

   SUGGESTED GRADE LEVEL: 4-12

4. Discuss the limits to exponential population growth in a closed system. Included should be the limiting factors of available nutrients (food), atmosphere and suitable habitats (substrates for attached marine organisms to housing and medical care for people.)

   SUGGESTED GRADE LEVEL: 10-12



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**concept:** 7 - The earth's energy resources and systems can support only limited numbers of people without drastic alterations in present technological and social systems.

**conservation**

**objective:** 7.4 - The student will understand that conservation planning is increasingly more important as individual consumption of energy has increased faster than population growth.

1. Plan an energy-efficient community which includes housing, shopping, schools, recreational facilities, transportation, etc. Take into consideration proximity of shopping to homes, type of housing, etc. Talk to local planning commission members, if possible.

   SUGGESTED GRADE LEVEL: 4-12

2. Analyze and compare the energy consumption of living in an apartment, a condominium, a single family dwelling, duplex, ranch.

   SUGGESTED GRADE LEVEL: 7-12

3. Given a one million population, design a community to meet its needs.

   SUGGESTED GRADE LEVEL: 4-9

4. Identify all the organizations which are involved in local, state, and regional planning for your area.
   - What do they do?
   - How do they interact with the public and other governmental bodies?
   - What decisions do they make that affect energy use in your community?

   SUGGESTED GRADE LEVEL: 7-12

5. Develop a model recycling society giving ways the recycling of materials could best be utilized.

   SUGGESTED GRADE LEVEL: 4-12

6. Compare the energy savings in a recycling society to a non-recycling society of the same population.

   SUGGESTED GRADE LEVEL: 4-12



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# activities

Concept 7
Objective 7.4 (continued)

7. Assume that a definite amount of energy is allotted to meet all your physical and psychological needs. Assume that amount of energy is about half which you presently consume. How would you modify your lifestyle to conform to the energy available?

SUGGESTED GRADE LEVEL: 7-12

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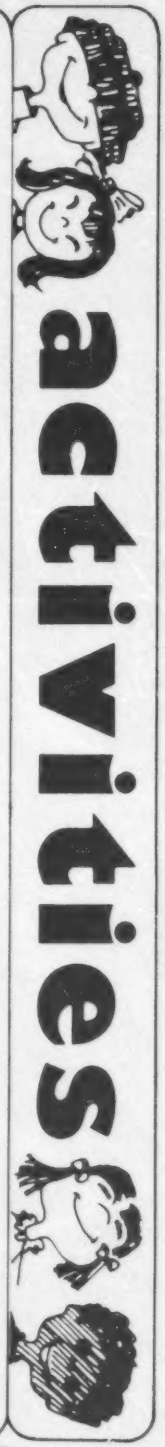
**concept:** 7 - The earth's energy resources and systems can support only limited numbers of people without drastic alterations in present technology and social systems.

**conservation**

**objective:** 7.5 - The student will understand that the world distribution of resources and population poses political, social and economic hazards.



## activities

1. Determine the effect of oil imports on the U.S. balance of payments.

   SUGGESTED GRADE LEVEL: 10-12

2. Prepare a graph showing the historical economic effects on minerals as they become more scarce--e.g., gold, platinum, copper, zinc, tin, etc.

   SUGGESTED GRADE LEVEL: 7-12

3. Identify the 15 rare minerals used by the U.S. Compare the domestic availability of these scarce resources to quantity imports.

   SUGGESTED GRADE LEVEL: 4-9

4. Assume that there are two industries located along a river. The industry located upstream is a paper mill which discharges certain wastes directly into the river. The second industry, located downstream, is an electric power plant. If the paper mill were not upstream, the electric power plant could use the river water for cooling purposes with very little or no treatment, but by discharging waste directly into the river, the paper mill has shifted some of the costs of producing paper (treating polluted water) onto the electric power plant. Even though the electric power plant hasn't polluted the water upstream, it must pay to clean up the water. On the other hand, the electric power plant is discharging heated water and, environmentalists claim, is thus changing the ecology of the river.

   Questions to consider include:
   - For what purpose does the paper mill use the river water?
   - For what purpose does the electric power plant use the river water?
   - What action, if any, could owners of the electric power plant take against the owners of the paper mill?
   - How could the managers of the electric power plant determine their costs of treating the polluted water released by the paper mill?
   - How does the electric power plant recover its costs for water treatment?
   - What should the owners of the electric power plant do about the heated discharges into the river?



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# activities

Concept 7
Objective 7.5 (continued)

- If the paper mill is allowed to use the river as a "free" dumping ground, will the cost of paper be cheaper?
- If the paper mill treated its waste water before releasing it, would this result in a significant increase in the cost of paper?
- What competitive advantage is given to a paper mill that doesn't have to treat its waste water over a paper mill that does?

SUGGESTED GRADE LEVEL: 7-12



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**concept:** 8 - Technological development affects energy conservation options.

**conservation**

**objective:** 8.1 - The student will understand that some technologies and activities use more energy than others.

## activities

1. Chart the gross amount of energy consumed in various societies with differing levels of technological advancement measured by GNP (Gross National Product). Using natural laws, chart the amount of energy that can be conserved by increasing the efficiency of various technological processes in each of these countries.

   SUGGESTED GRADE LEVEL: 10-12

2. Compare the energy efficiency of a large truck to that of a standard automobile.

   SUGGESTED GRADE LEVEL: 4-9

3. Compare the uses of electric energy by the aluminum companies of the Northwest with total electric consumption by all other electrical users. Find out the rates per kilowatt hour for each user type from your local power company public relations office.

   SUGGESTED GRADE LEVEL: 9-12

4. Determine the energy savings between processing one ton of bauxite (aluminum ore) and one ton of aluminum produced from recycled cans.

   SUGGESTED GRADE LEVEL: 7-12

5. Bring both a mini-bike and a 10-speed bike to class. Inventory the parts of both machines. Estimate the costs of each part by use of a parts catalog. What would it cost to fabricate both machines from the ground up? Why is the bike cheaper? (Note to teacher: Cost of energy is reflected as part of the total cost.) (For primary students, compare toys they are familiar with and do the same thing as above.)

   SUGGESTED GRADE LEVEL: K-6

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**concept:** 8 - Technological development affects energy conservation options.

**conservation**

**objective:** 8.2 - The student will understand that some technological processes used in conservation practices use energy.

## activities

1. Determine the amount (percentage) of energy produced at a coal electrical power plant that is used to operate electrostatic precipitators, scrubbers, or other environmental protection devices.

   SUGGESTED GRADE LEVEL: 10-12

2. Visit a sewage treatment plant to observe the plant process and determine the amount of energy required to operate the facility. Determine the daily and/or monthly per capita energy requirements of the plant.

   SUGGESTED GRADE LEVEL: 4-9

3. Collect pictures of conservation practices and construct a collage showing those practices that use energy and one for those that do not use energy.

   SUGGESTED GRADE LEVEL: 3-9

4. Select a topic from the list of conservation practices listed below and write a short paper on the cost of energy to implement this practice.

   - insulation
   - solar panels
   - thermopane
   - wood stoves
   - aluminum can recycling
   - returnable glass containers
   - contour plowing, etc.

   SUGGESTED GRADE LEVEL: 7-12

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**concept:** 8 - Technological development affects energy conservation options.

**conservation**

**objective:** 8.3 - The student will understand that high technology societies have differing levels of responsibility to conserve the earth's resources than do low technology societies.

## activities

1. Have a class discussion about the political and economic problems that exist when some societies have a large percentage of the world's resources.

   SUGGESTED GRADE LEVEL: 10-12

2. Discuss why the U.S. should conserve energy so that it can be shared with other countries. (Example: the less Mideast oil the U.S. consumes, the more that is available for use by other countries.)

   SUGGESTED GRADE LEVEL: 10-12

3. Discuss which countries--industrialized or non-industrialized--have suffered the most from the increased costs of energy. Explain.

   SUGGESTED GRADE LEVEL: 4-9

4. List examples of technological processes and jobs which will be eliminated by the depletion of certain resources, i.e. coal, natural gas, petroleum.

   SUGGESTED GRADE LEVEL: 10-12

5. List the major industries in your community. Write letters asking them to describe their approach to energy conservation.

   SUGGESTED GRADE LEVEL: 4-12

6. Visit a number of local industries. Describe the constraints put on them by energy resource limits.

   SUGGESTED GRADE LEVEL: 4-12

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**concept:** 8 - Technological development affects energy conservation options.

**conservation**

**objective:** 8.4 - The student will understand that the rate of energy use with technological development has increased exponentially over time.

**activities**

1. Chart the history of coal utilization in the U.S. as related to technological development.

   SUGGESTED GRADE LEVEL: 4-12

2. Compare the percent of energy consumption before and after the introduction of a technological advance (i.e. before and after steamboat, cotton gin, etc.)

   SUGGESTED GRADE LEVEL: 7-12

3. Prepare a graph showing the growth of the U.S. automobile industry as related to the availability of petroleum.

   SUGGESTED GRADE LEVEL: 4-12

4. Secure graphs of as many energy sources as possible which depict historical usage of the various sources. Identify those where use has grown exponentially.

   SUGGESTED GRADE LEVEL: 10-12



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**concept:** 8 - Technological development affects energy conservation options.

**conservation**

**objective:** 8.5 - The student will understand that technologies are judged by their combined aesthetic, ethical/legal, utilitarian, and scientific impacts.

## activities

1. Prepare a list of guidelines that should be considered in an environmental impact statement that might be developed for the construction of a hydroelectric dam.

   SUGGESTED GRADE LEVEL: 7-12

2. Prepare a plan for developing recreation facilities for public use at a hydroelectric dam.

   SUGGESTED GRADE LEVEL: 10-12

3. Investigate the architectural theories of Paulo Solari and his Arcologies. (See book by same name in local library or Reader's Guide articles.)

   SUGGESTED GRADE LEVEL: 10-12

4. Research C.A. Doxiadis and his work in ekistics, the science of human settlement.

   SUGGESTED GRADE LEVEL: 10-12

5. Visit a bottling plant and find out what the company is doing about recycling. Discuss methods and costs of recycling in contrast to throw-away containers.

   SUGGESTED GRADE LEVEL: 3-12

6. List ways of using to advantage the waste heat produced by power-generating plants.

   SUGGESTED GRADE LEVEL: 10-12

7. Describe how air pollutants destroy the beauty of the environment.

   SUGGESTED GRADE LEVEL: 4-12

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# activities

Concept 8
Objective 8.5 (continued)

8. Compare the ecological impact of wind generated energy with the aesthetic impact caused by the appearance of windmills.

SUGGESTED GRADE LEVEL: 4-12

9. Design an aesthetically pleasing windmill; display products.

SUGGESTED GRADE LEVEL: 4-12

10. Design an aesthetically pleasing solar collector.

SUGGESTED GRADE LEVEL: 4-12

11. Compare "efficiency of conversion" of:
- 1910 coal plant
- 1970 coal plant
- 1970 nuclear plant
- 1970 MHD
- 1960 hydro system

SUGGESTED GRADE LEVEL: 10-12

12. Electric cars have been proposed as a transport of the future. Present limitations include the need for batteries which will go farther without being recharged. Are these batteries limited by technology or by material costs and availability?

SUGGESTED GRADE LEVEL: 9-12



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**concept:** 8 - Technological development affects energy conservation options.

**conservation**

**objective:** 8.6 - The student will understand that technological development is affected by the availability of resources.

## activities

1. Trace the use of strategic minerals to their use in industrial processes. Identify the effect on some technological processes when the strategic minerals become less and less available and more expensive.

   SUGGESTED GRADE LEVEL: 7-12

2. Debate: Do high technology societies have a responsibility to share resources with other nations?

   SUGGESTED GRADE LEVEL: 7-12

3. Deliberately provide less than sufficient construction paper (initially) to construct a Christmas chain of red and green links. Every time a student requests more supplies, emphasize the operating reality of this objective.

   SUGGESTED GRADE LEVEL: 1-6

4. Secure an encyclopedia or economic atlas of the world and compare the availability of some resources between the United States and Guatemala. Write a short paper describing how this availability or unavailability limits technological development.

   SUGGESTED GRADE LEVEL: 10-12

5. Determine the impact that recycling of metals will have on our future supply of minerals.

   SUGGESTED GRADE LEVEL: 10-12

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**concept:** 8 - Technological development affects energy conservation options.

**conservation**

**objective:** 8.7 - The student will understand that humankind is using the earth's resources at an ever-increasing rate and this rate far exceeds the rate of energy resource replacement by biogeochemical processes.

## activities

1. Prepare an historical pictorial line graph showing the process of the earth's developmental process of petroleum and identify the time required for the natural process to produce oil.

   SUGGESTED GRADE LEVEL: 4-9

2. Prepare a graph that shows the use and time that U.S. oil has been developed and used.

   SUGGESTED GRADE LEVEL: 4-9

3. List some ways of conserving fossil fuels to extend supply.

   SUGGESTED GRADE LEVEL: 4-9

4. Why does the cost of copper rise? Research and explain.

   SUGGESTED GRADE LEVEL: 9-12

5. Secure a map from the Bonneville Power Administration and locate the position of hydroelectric dams along the lower Columbia River. Compare the availability of water with the availability of new dam sites on the lower river. What are the implications of your findings?

   SUGGESTED GRADE LEVEL: 9-12

6. Bring to class a large box of raisins and dispense to each child one at a time for several days. Each day add 10 raisins to the initial stock. After a period of time, the students should discover that they are going to run out of this source of food because they are using it up faster than it is being replaced. Relate this activity to the depletion of the world's energy resources such as gasoline, oil, coal, etc.

   SUGGESTED GRADE LEVEL: K-6

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**concept:** 8 - Technological development affects energy conservation options.

**conservation**

**objective:** 8.8 - The student will understand that industrial societies have a greater per capita impact on the environment than do agrarian societies.

# activities

1. Compute the differing amounts of automobile emissions in different countries or population densities.

   SUGGESTED GRADE LEVEL: 4-9

2. Compare the amount of garbage produced by agrarian and industrial society families.

   SUGGESTED GRADE LEVEL: 4-9

3. Compare the lifestyles of families living in technological and agrarian societies. List examples of items that have the greater impact on the environment.

   SUGGESTED GRADE LEVEL: 4-9

4. By using maps, compare the world resource distribution patterns with the world import activity of similar resources. Has your study indicated the impact of industrial societies on agrarian societies?

   SUGGESTED GRADE LEVEL: 9-12

5. Describe the characteristics of a primitive agrarian society as related to energy. Groups to study could be the Masai of Kenya, the Hindu of India, or the Kurds of Iraq.

   SUGGESTED GRADE LEVEL: 4-12

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**concept:** 8 - Technological development affects energy conservation options.

**conservation**

**objective:** 8.9 - The student will understand that energy conservation practices can reduce the environmental impact of technological development.

## activities

1. List the benefits of improving gasoline mileage of automobiles.

   SUGGESTED GRADE LEVEL: 4-12

2. Describe how an electrostatic precipitator can improve air quality.

   SUGGESTED GRADE LEVEL: 10-12

3. Discuss what effect does the increase use of insulation in buildings have on the future need for additional energy sources, i.e. electrical power plants.

   SUGGESTED GRADE LEVEL: 6-12

4. Construct a collage of pictures illustrating the damaging effects of strip mining. Compare it with a collage of pictures illustrating strip-mined areas that have been reclaimed by new technological developments.

   SUGGESTED GRADE LEVEL: 4-9

5. Locate waste heat sources in local industrial plants and retail outlets. Devise coversion systems to divert the waste heat into useable energy. Compute the BTUs or kilowatts which could be recaptured (or conserved) by these processes.

   SUGGESTED GRADE LEVEL: 10-12

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**concept:** 8 - Technological development affects conservation options.

**conservation**

**objective:** 8.10 - The student will understand that energy conservation practices create technological and industrial change.

# activities

1. Calculate the cost to automobile companies to retool to make smaller cars.

   SUGGESTED GRADE LEVEL: 10-12

2. Compute the cost to the bottling industry of complying with the bottle bill.

   SUGGESTED GRADE LEVEL: 10-12

3. Contact a local industrial plant and ask what steps they have implemented to improve energy conservation.

   SUGGESTED GRADE LEVEL: 7-12

4. Collect articles from Motor Trend magazine on the increased sale of foreign compacts in the U.S. and compare the sales figures with those for American luxury cars. According to the articles, what has been the response of American manufacturers to the competitors?

   SUGGESTED GRADE LEVEL: 7-12

5. Invite an architect and/or building contractor to share with students the structural changes being made in new and old buildings which help to reduce energy loss.

   SUGGESTED GRADE LEVEL: 4-12

6. Invite a local utility or manufacturing representative to class to demonstrate to students how storm windows or double glazed windows function. Have h/er compare by demonstrating the difference between single pane and double pane windows.

   SUGGESTED GRADE LEVEL: K-6

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# activities

Concept 8
Objective 8.10 (continued)

7. Have a debate on this topic: "Resolved: Family structures change in response to limited energy resources." For example, what else is there to do if there isn't electricity for the television set?

SUGGESTED GRADE LEVEL: 4-12

8. Working in groups, design and construct model energy efficient homes.

SUGGESTED GRADE LEVEL: 4-12

9. Working in groups, design and construct a model home which uses solar and wind energy captured on the home site. (See Mother Earth News and Popular Science articles on solar and wind power. See also Direct Use of the Sun's Energy, Ballantine Books.)

SUGGESTED GRADE LEVEL: 4-12

10. Plan and build models of energy-efficient homes after hearing an architect's presentation on energy-efficient structures. (Film on Solar Heating of Schools, available from Senator Mike McCormick, Federal Building, Richland, WA 95350.)

SUGGESTED GRADE LEVEL: 10-12

11. Devise a model housing construction code designed to conserve energy.

SUGGESTED GRADE LEVEL: 4-12

12. Build a series of solar heaters for standard size aquariums. Compare efficiency between the designs.

SUGGESTED GRADE LEVEL: 7-12



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**EVALUATION**
**Conservation of Energy**

The ENERGY and MAN'S ENVIRONMENT program actively seeks your ideas, comments, and general suggestions about this *Activity Guide*. If you feel there are ways this *Activity Guide* could be improved, or if more or different learning objectives or activities could be added, please let us hear from you. In anticipation of our request, we ask that you keep a careful record of all specific activities which are tried in your classroom. Please rate the effectiveness of each activity according to the following scale.

**EVALUATION Conservation of Energy**

| Concept Number | Objective Number | Activity Number | not at all useful 1 2 average 3 4 highly effective 5 | Comment Suggestion |
|---|---|---|---|---|
| | | | EXAMPLE | |
| III | 2 | 2 | ✓ | students enjoyed very much |
| III | 4 | 5 | ✓ | students enjoyed very much |
| II | 1 | 3 | ✓ | too difficult for age level |
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